95

AMERICAN ANTIQUITY

Museum
E
51
A495

ANTHROPOLOGY

THE UNIVERSITY
OF MICHIGAN
MAY 2 1961
MUSEUMS
LIBRARY

VOLUME 26

NUMBER 3, PART 1

JANUARY 1961

PUBLISHED BY THE SOCIETY
FOR AMERICAN ARCHAEOLOGY

THE SOCIETY FOR AMERICAN ARCHAEOLOGY

President: ERIK K. REED, 238 Griffin St., Santa Fe, N. M.

President-Elect: JUNIUS B. BIRD, American Museum of Natural History, Central Park West at 79th St., New York 24, N.Y.

Secretary: JOE BEN WHEAT, University of Colorado Museum, Boulder, Colo.

Treasurer: JAMES L. SWAUGER, Carnegie Museum, Pittsburgh 13, Pa.

Executive Committee Members: WILLIAM R. COE (to 1961), University Museum, Philadelphia 4, Pa.; ROBERT H. LISTER (to 1961), Department of Anthropology, University of Colorado, Boulder, Colo.; IGNACIO BERNAL (to 1962), Tres Picos 65, Mexico 5, D.F.; CHARLES E. BORDEN (to 1962), Department of Anthropology and Sociology, Division of Archaeology, University of British Columbia, Vancouver 8, B.C.

Editor: RAYMOND H. THOMPSON, Department of Anthropology, University of Arizona, Tucson, Ariz.

Editor of "Abstracts of New World Archaeology": RICHARD B. WOODBURY, Department of Anthropology, University of Arizona, Tucson, Ariz.

Editor of "Archives of Archaeology": DAVID A. BAERREIS, Department of Anthropology, Sterling Hall, University of Wisconsin, Madison 6, Wisc.

Associate Editor for Reviews: DONALD COLLIER, Chicago Natural History Museum, Chicago 5, Ill.

Associate Editor for Notes and News: NATHALIE F. S. WOODBURY, Arizona State Museum, Tucson, Ariz.

Assistant Editors: ARCTIC — JOHN M. CAMPBELL, Dept. of Soc. and Anthro., George Washington Univ., Washington 6, D.C.; CALIFORNIA — FRANCIS A. RIDDELL, History Sec., State Div. of Beaches and Parks, Box 2390, Sacramento 11, Calif.; CARIBBEAN — PATRICK GALLAGHER, Dept. of Anthro., Yale Univ., New Haven, Conn.; GREAT BASIN — WILLIAM J. WALLACE, Dept. of Anthro., Univ. of Southern California, Los Angeles 7, Calif.; HIGHLAND SOUTH AMERICA — JOHN H. ROWE, Dept. of Anthro., Univ. of California, Berkeley 4, Calif.; LOWLAND SOUTH AMERICA — BETTY J. MEGGERS, U.S. National Museum, Washington 25, D.C.; MIDDLE AMERICA — H. B. NICHOLSON, Dept. of Anthro. and Soc., Univ. of California, Los Angeles 24, Calif.; NORTHEAST — ALFRED K. GUTHE, Rochester Museum of Arts and Sciences, Rochester, N.Y.; NORTHERN MISSISSIPPI VALLEY — WARREN L. WITTRY, Illinois State Museum, Springfield, Ill.; NORTHWEST — CHARLES E. BORDEN, Dept. of Anthro. and Soc., Div. of Archaeology, Univ. of British Columbia, Vancouver 8, B.C.; PLAINS — ROBERT L. STEPHENSON, River Basin Surveys, 1517 O Street, Lincoln 8, Neb.; SOUTHEAST — CHARLES H. FAIRBANKS, Dept. of Anthro., Florida State Univ., Tallahassee, Fla.; SOUTHWEST — WILLIAM W. WASLEY, Arizona State Museum, Tucson, Ariz.

Editorial Assistant: MOLLY K. THOMPSON, 2637 N. Plumer Ave., Tucson, Ariz.

AMERICAN ANTIQUITY publishes original papers on the archaeology of the New World and closely related subjects. Articles and "Facts and Comments" should be submitted to the Editor, publications for review to the Associate Editor for Reviews, and information for "Notes and News" to the appropriate Assistant Editor. AMERICAN ANTIQUITY is not available for exchange.

AMERICAN ANTIQUITY is published quarterly in July, October, January, and April by the Society for American Archaeology at the University of Utah Press, Salt Lake City 12, Utah. Entered as second-class matter June 1, 1951, at the Post Office, Salt Lake City, Utah, under the Act of March 3, 1879. Subscription is by membership in the Society for American Archaeology; annual dues are $8.00, of which $7.00 are for a subscription to AMERICAN ANTIQUITY and other regular publications of the Society as issued. Address requests for membership or other information to the Secretary. Send instructions for change of address to Society for American Archaeology, 1530 P Street, N.W., Washington 5, D.C. See inside back cover for information on ordering back issues of AMERICAN ANTIQUITY and other publications of the Society which are still in print.

AMERICAN ANTIQUITY

VOLUME 26 JANUARY 1961 NUMBER 3, PART 1

THE ARCHAIC OF THE LOWER MISSISSIPPI VALLEY

WILLIAM G. HAAG

ABSTRACT

No archaeological remains which the majority of specialists will accept as Archaic have been found in the Mississippi Valley from the mouth of Ohio River to the Gulf of Mexico. Despite this, the literature reflects a general acceptance of the belief that the Archaic stage is well represented in the Lower Valley. The presence of concentrated Archaic populations in northern Alabama and western Tennessee and Kentucky has given comparative support to these expectations and has provided part of the source for some of the hypothetical statements in the literature of what the Lower Valley Archaic ought to be like. Although the failure of writers to agree on a definition of Archaic which will satisfy the evidence in all of the areas of Eastern United States has contributed to the problem of identifying Archaic materials in the Lower Valley, the lack of these remains can best be explained by the geology of the region. The cutting and filling of the Alluvial Valley during the Pleistocene changes in sea level have removed or buried all of the surfaces that might have been occupied by Archaic peoples. The surface of the Alluvial Valley is everywhere less than 5000 years old. Possible Late Archaic sites are located on old stable beach ridges or near enough to the Pleistocene terraces not to have been included in the general pattern of Recent coastal subsidence. It is concluded that Archaic or earlier materials are absent in the Lower Alluvial Valley of the Mississippi River. Neither Tchefuncte nor Copell are accepted as Archaic; Poverty Point is viewed as transitional from an Upper Archaic tradition to some phase of the Formative stage. Poverty Point materials may not be expected to be found in quantity along the Gulf Coast of the Mississippi Delta region.

ARCHAEOLOGICAL literature pertaining to the Lower Mississippi River Valley indicates a general acceptance of the belief that the Archaic stage is well represented there. The Lower Valley has been defined as the Alluvial Valley plus affected tributaries; thus, roughly, it is the valley from the mouth of the Ohio River to the Gulf of Mexico. The major emphasis of this paper will be upon any expressions of the Archaic found in the two states of Mississippi and Louisiana. These states bracket the Lower Valley, and if the Archaic stage is represented in the area, it should be apparent here.

Part of the task of writing a note about the Archaic in this area included the rereading of an article that attempted an early synthesis of the Archaic in the Southeast (Haag 1942). One may still agree largely with some of the conclusions, but the major theme of that paper demanded a second look. Its contention was that there was a widespread, hunting-gathering folk of relatively simple material culture and ignorant of pottery, who extended from Atlantic to Pacific and were of common origin. Despite many and often spectacular differences, there seemed — in 1942, anyway — an underlying similarity to the many manifestations of this culture type that implied some common ancestry. Although the majority of subsequent writings which have touched upon the subject of the Eastern Archaic have more or less implied that its relationships were quite widespread, some eastern archaeologists are now fairly certain that the relationships are more apparent than genetic. Nevertheless, the most recent syntheses of American prehistory have indicated a return to a firm position of acceptance of the Archaic stage as continental in distribution although varying in expression (Willey and Phillips 1958: 105; Byers 1959: 232; Kelley 1959: 276).

Two decades ago there was launched a comprehensive examination of the archaeology of the Lower Mississippi River Valley. This area includes the Alluvial Valley from the mouth of the Ohio River to the Gulf. The investigators limited their Survey area to the portion of the region between Cairo and Vicksburg, but the actual field work intensively covered only from Memphis to the Arkansas-Louisiana state line. Within this area little evidence of typical Archaic occupation could be found (Phillips, Ford, and Griffin 1951: 429). In another publication of about the same date, Griffin (1952b: 228) also noted, "Unfortunately, there is very little evidence for the presence of man in the

Central Mississippi Valley during the Archaic Period." Griffin's "Central Mississippi Valley" covered the same area or nearly so as did the "Lower Mississippi" in the "Survey" volume. In the same article and on the page above cited, Griffin states, "To the south, in the Lower Mississippi Valley near the Gulf, one site has been found which is comparable to a part of the Archaic Indian cultures of the Southeast." It may be assumed that the Copell site is here indicated although it is not identified. Ford and Quimby (1945: 92) once concluded that the Louisiana Tchefuncte sites were Late Archaic and the Copell site was somewhat earlier. It is not likely that either author would classify Tchefuncte as Archaic today, although Willey and Phillips (1958: 116) do so. W. H. Sears (1948) has pointed out the varying attitudes toward the Archaic, but has indicated the general acceptance of this as a stage of cultural growth in North America. Everywhere the Archaic is easy to recognize, but quite difficult to define in acceptable terms.

Since the publication of these articles there have been several significant contributions to the literature of southeastern archaeology. The last decade has seen the development of a period of synthesis in American archaeology, and some of the writings have been related specifically to the Lower Valley of the Mississippi River. Without dwelling upon their details at this point, one may point out that there is not only an acceptance of an Archaic stage but a general use of the terms "Early" and "Late." The best statement of this is in Griffin's "Culture Periods in Eastern United States Archeology," although his treatment generalizes for the whole of the East (Griffin 1952a: 354). Contrariwise, Willey and Phillips (1958: 105) cannot find justification for this two-fold division. The description of the Late Archaic that appears in Phillips, Ford, and Griffin (1951) is certainly vivid enough, but again, the description is of a hypothetical amalgamation of Archaic traits that do not exist within the Valley proper. I have made a somewhat similar contribution in a description of the cultures represented within the state of Mississippi, although in this instance it was to show the anomaly of the absence of Archaic throughout most of the state (Haag 1955: 85). Valid application of "Early" and "Late" must be confined to local sequences of the Archaic.

Jennings (1952: 257) noted the differences existing between the Archaic sites of the Lower Valley and elsewhere:

> It is true that between the Archaic (this term is here meant to include the general level of *prepottery* development found all over the Southeast) and the Early Woodland cultures (we here allow Tchefuncte to typify) the differences are not great.

Apparently, only in Louisiana were true Archaic sites to be found. This Archaic was somewhat fabricated by listing the nonpottery traits from the Tchefuncte sites of Louisiana. It can not be denied that Tchefuncte is, like many another southeastern phase, basically Archaic, but with the addition of pottery, mounds, burial traits, and a few other things. The Copell site was included by Jennings in the list of Tchefuncte sites but was judged to be "true" Archaic because it lacked pottery.

If we disregard his hypothetical social organization and crafts, Griffin's Early Archaic includes, "flaked choppers, axes and hoes, which are the forerunners of the polished or ground forms" (1952a: 354). Additional specifically-known items are large, stemmed, and corner-notched projectile points of both percussion and pressure chipping, spearthrowers, fishhooks, shallow stone mortars and hand mullers, cylindrical and bell-shaped pestles, bone awls, and other cut-bone implements. Other traits would be the utilization of the habitation area for primary and secondary burials of humans and dogs, use of shell fish, and "hot-rock" cooking or stone boiling.

This definition coincides only in part with the "Preceramic Period" of the Lower Mississippi Valley Survey set forth by Phillips, Ford, and Griffin (1951: 429). This description of the Archaic included in a single phase Griffin's Early and Late Archaic, although greater emphasis was placed upon characteristics of the Late Archaic. Actually, no Archaic remains were found within the Survey area as stated above, but "such sites are presumed to exist."

Griffin (1952a: 355) recognized the Late Archaic from

> celts which probably preceded the appearance of the full-grooved ax, numerous forms which have been called bannerstones or boatstones, some of which were almost certainly used along with the atlatl as has been evidenced by numerous instances, particularly in the southeast, and the tubular or subconical form called a pipe.

Shell beads, incised bone pins, painted bone implements, barbed harpoons (in the North),

stone and hematite plummets (in the South), copper (especially in the Lake Superior area), marine shell implements (in the Southeast), tubular pipes, steatite and sandstone bowls were added to the material culture.

The center for the development of the polished stone complex was in the northern Great Lakes area and in the middle South; it only feebly penetrated into the lower Mississippi Valley and into the far Southeast (Griffin 1952a: 355).

Other noteworthy traits are extended burials, cremations, red ocher with burials, and use of human bones for artifacts.

The latest version of the Archaic stage of Willey and Phillips (1958: 107–11) would include all of this and some things more, yet still the idea of single "stage" is inherent in their definition. They see the Archaic as an outgrowth of the preceding (usually) Lithic stage hunting and gathering with a shift in emphasis between hunting and gathering to favor the latter. Hence, the appearance of incipient agriculture and the introduction of pottery does not do violence to their concept of the Archaic, albeit, these items appear at the close of the Archaic. To these authors, agriculture does not become culturally significant until it virtually dominates the economy of peoples. Thus, they contend that there is no significant break in prehistory between the Lithic cultures and the Archaic; the "grand twofold division" in American prehistory exists but "the hinge comes later in the sequence, viz., between the Archaic and the Formative" (Willey and Phillips 1958: 80). Formative is that stage when agriculture becomes the basis of the economy and greater things are possible, such as the development of a Classic stage.

This definition of the Archaic is not directly reconcilable with pre-existing ones and protesting voices have been heard (Caldwell 1958: 71; Griffin 1959: 415). It would seem apparent that no single definition of Archaic satisfies local conditions throughout the whole of the Americas much less the Lower Mississippi River Valley. Hence, it may be warranted to state to which Archaic this paper refers. Despite the fact that pottery had little or no material effect upon individual cultures as it was added to them, pottery is a fine handmaiden and its near indestructibility (often unfortunate) means that, unlike agriculture, it may be readily discerned. In a like manner, polished or ground stone artifacts may be distinguished. For simplicity and only in its local application, we will consider the Archaic as a single tradition, characterized by polished stone artifacts such as atlatl weights, adzes, plummets, stone vessels of sandstone and steatite, tubular pipes a variety of stemmed and notched projectile points and other chipped stone implements, many bone and shell ornaments and implements, stone boiling, and dog and human burials. A number of socio-cultural traits might be surmized but they are not too diagnostic in this study.

The Lower Valley area may now be considered in the light of this eclectic Archaic. There is no necessity for concern with the Lithic stage (of Willey and Phillips) for representation in the South in general is meager and none is known for the Lower Valley. C. H. Webb (1948: 230) has reported a number of isolated occurrences of fluted points and Early Archaic projectile points in northwestern Louisiana but no sites of such antiquity have been found. The relationships of western Kentucky and Tennessee Archaic sites with Alabama have been recently tabulated (Lewis and Kneberg 1959). In addition to Soday's important Quad site (Soday 1954), it should be mentioned that he has collected from a large number of sites in the Florida parishes of eastern Louisiana that are characterized by a series of types of rather rough flints that do not appear to have pottery in association. It is not possible adequately to evaluate these finds at this time since they have not been published nor are they available for study. However, in view of the concentration of typical Archaic populations in northern Alabama, western Tennessee and western Kentucky there seems little reason — geological or ecological — for the absence of Archaic sites in this part of Louisiana and neighboring Mississippi.

Although the authors of the Survey volume assumed that Archaic sites must exist in the Alluvial Valley of the River, there is an excellent geologic basis for their absence, or at least, for our inability to find them. Whereas, geological interpretations of the Pleistocene have sought to establish the relationships of the various glacial remains along the terminal moraines and lower margins of the ice sheets, far greater yields of information may be had along the lower courses of the major streams, especially the Mississippi which was activated and reactivated by the ebb and flow of the

melt waters from the glacial sheets of central North America (Russell 1940). It is clear that there were at least five major glacial periods during the Pleistocene when considerable sea water was trapped as ice and lowered sea level resulted. After each glacial advance, the ice melted back so that sea level rose approximately to the present heights. Following the first glacial maximum, melt back began and sea water encroached gradually on the then-exposed continental shelf, depositing sediments as it did so. When present sea level was reached, the Lower Mississippi began to meander and eventually the entire Lower Valley from Cairo to the Gulf was alluviated (Fisk 1944). When the second major ice accumulation began in northern latitudes, sea level was lowered, the continental shelf was again exposed, and the Mississippi River gradient so increased that it entrenched itself some hundreds of feet in the first interglacial alluvium, which now was preserved as a terrace along the stream flanks. In Louisiana, four such terraces are well defined; their surfaces slope toward the Gulf at gradually increasing angles, the oldest sloping the most steeply. This difference in the angle of slope of the four terraces is because of the great accumulation of sediments in the Gulf that brought on downwarping of the Embayment and a compensating isostatic rise of the interior of the continent.

When sea level rose for the last time to the present stand, it did so gradually and continuously. The theory that sea level rose some 6 m. above the present level about 3000 B.C. and then receded to modern conditions about A.D. 850 is debatable and without confirming evidence (LeBlanc and Bernard 1954). The present sea level was reached about 5000 years ago and has remained stationary since that time. When this level was reached, the Mississippi River from Cairo south began to meander and in the last five millennia the valley has been filled again with alluvium between the terrace faces. No part of this last alluvial surface may be judged to be older than 3000 B.C.; these are the deposits of Recent age (Fisk and McFarlan 1955: 280). The alluviated valley of the Lower Mississippi is characterized by many abandoned meander belts, back-swamp lowlands, and natural levees. Although the Mississippi River has the largest alluviated plain of all North American streams, it is not unique. Similar conditions on a smaller scale obtain in "all other Recent alluvial valleys of the Gulf coast from western Florida to the Mexican boundary" (LeBlanc and Bernard 1954: 186). Similar terrace conditions have been defined in the Rhone, the Meander, and perhaps the Rhine river valleys, although it is not necessarily true that all valleys should show the same number of terraces (Russell 1957). Not all carry the same amount of water or sediments. In some instances older alluvium has been completely removed by subsequent stream action.

The last glacial advance — Late Wisconsin — must have lowered the level of the oceans over 400 feet (Fisk 1944). The beginning of the following rise may be fixed at approximately 18,000 years ago. Surfaces on the continental shelf that were exposed during this time were thoroughly oxidized and may be easily detected in bore-holes. As the sea encroached, it laid down a cover of sediment over this older shelf surface. Certainly, inhabitants of the Gulf Coast of the time about 18,000 years ago probably would have been living near 100 miles south of the present coastline.

One may speculate for a moment about the possibilities of finding important artifacts on the shelves. Sea coasts and coastal plains attract the heaviest concentrations of population today, and it is reasonable to believe that they did so in the past. When better methods are found for boring and excavating submerged sediments it is possible that archeology will experience an era of astonishing discoveries. In any event, discoveries await investigations below the blanket of Recent sediments, rather than the explorations of "divers" (Russell 1957).

If there were men living in the present area of the alluviated valley of the Lower Mississippi during the period of 18,000 to 5000 years ago, their remains must be under a cover of many feet of sediments. Hence, the Island 35 mastodon could be deeply buried and of the order of 10,000 years old (Williams 1957: 362). Since the exposed terrace shoulders of these times must have been ecologically rather uninviting, even in these latter areas Archaic remains can hardly be expected in any profusion. It has been demonstrated that cultural remains in the Lower Valley seem to be associated with active streams (McIntire 1958). Thus it may be seen how the geological history of the area well explains the absence of Lithic and Archaic remains in the region.

When attention is directed to what Griffin called Upper Archaic manifestations, more candidates for the Valley are to be seen, but

still an amazingly sparse representation is found. Because of the nearness of the Alabama shell heaps and the Eva phase materials to the Valley, it would be expected that considerable remains of Upper Archaic sites would be found, but again this is not true. It seems an anomalous situation, if the Eva phase persisted for several millennia, that none of this material is to be seen to the west and south. There is some indication that in the Coldwater River drainage a few sites may have Late Archaic flint types, but this is not very indicative of a large population. Flint types are poor phase "markers" to say the least. Robert Wauchope reported at the 13th Southeastern Archaeological Conference that of 29 projectile point types he could identify for Georgia, 28 were established by the close of the Archaic. Across the Mississippi River from the area in which the Eva phase occurs, Archaic sites are nearly nonexistent. Down on the Louisiana Gulf Coast and inland 100 miles, a survey of more than 500 sites failed to disclose any Archaic materials.

The oldest isolated culture recognized in the survey area is the Tchefuncte period. It has been theorized that the Archaic or non-pottery horizon also exists but no definite evidence was found during the survey (McIntire 1958: 53).

However, it was pointed out in this study that the physical environment is such that Archaic (non-pottery) sites might be difficult to locate. There are old beach ridges of shell which might look like non-pottery middens and, were they actually middens, the bone content is not likely to be preserved. The Copell site was within the survey area of McIntire's study; he, as did Ford and Quimby (1945: 17), concluded that Copell was an early Tchefuncte site despite the lack of pottery, which hardly would be expected on the site because it is essentially a burial site rather than a village midden (Collins 1927; Miller 1950: 282–3). The catalogue of objects associated with the Copell burials includes chipped flint knives and points, elliptical bar weights, a boatstone, numerous bone and shell ornaments, an atlatl hook of antler, clam shells with asphalt, and other traits shared with the Tchefuncte sites of Louisiana (Webb 1948: 227). The Copell site is not considered here to be Upper Archaic.

In addition to the cheniers or old beach ridges that characterize coastal Louisiana there are several examples of another feature that certainly has considerable geologic antiquity and would have been attractive to Archaic man in this region. These are the "salt domes" of the coastal region, usually standing as "islands" in the coastal marshlands. The fact that they are high ground, often with saline springs, made them attractive to animals and man. None of these has ever been properly investigated yet mastodon remains have been found on one of them, Avery Island. This latter site is the subject of a current survey.

It should be noted that there have been innumerable finds of mastodon and mammoth remains within the Lower Mississippi Valley. Within the last two years two occurrences have been noted within a few miles of Baton Rouge, Louisiana. Each of these specimens appears to be secondary deposit, the usual situation for proboscidean fossils in eastern North America. The Island 35 Mastodon (Williams 1957) with artifacts in possible association could be quite old or quite recent. In my own experience, these finds are invariably at the base of the Recent alluvium, in gravels, and directly on top of the older Pleistocene clays. Only the most rigorously careful field examination of such materials in situ can make them of any value in studies of the antiquity of man.

One of the best candidates for Archaic in the Lower Valley is the Poverty Point culture (Ford and Webb 1956). It has been so designated by the above authors, but Willey and Phillips have considered it to belong in the Formative stage, primarily on the basis of the large earthworks that distinguish the type site. It is certainly apparent that the culture does possess some elements that are characteristic of the Archaic as well as distinctive traits that are Hopewellian. If Poverty Point is Archaic then Hopewell, Adena, and Marksville should be so classified. Ever since the St. Louis Midwestern Archaeology Conference of 1929 it has been difficult to find a classificatory home for Hopewell and its affinities.

Despite the conclusion that the Poverty Point culture is nonceramic, it is difficult to imagine how so large a population, as must have been necessary for the construction of the various tremendous earthworks and mounds, might have been maintained. The great shell heaps of northern Alabama were always near a riffle, the natural breeding and feeding ground of fresh-water mussels, hence, a readily accessible food supply. Neither Poverty Point nor Jaketown are situated near any wild food supply

of any unusual proportions. It seems that the great amounts and considerable depth of the midden suggest long, continuous, and heavy occupation of the sites; they were not "ceremonial" centers visited only on Sundays.

Since the remainder of possible Upper Archaic sites has been written off as unimportant or not admissible, Poverty Point and related sites must be carefully evaluated. When first described there seemed little doubt that the Poverty Point materials belong with Late Archaic or possible Tchefuncte, whatever one might conclude the latter to be (Webb 1948). Griffin (1952b: 228) included Poverty Point with other Archaic manifestations, and Jennings (1952: 259) did likewise. Phillips, Ford, and Griffin (1951: 430) continued the trend and so did Ford, Phillips, and Haag (1955: 152). However, in the latter instance there was a considerable amount of qualification and the choice seemed to waver between Late Archaic and "Early Woodland." Indications of how much waver there was may be seen in the fact that Phillips (1953: 183), prior to the publication of the Jaketown report, in a review of Jennings "Prehistory of the Lower Mississippi Valley" had written, "Poverty Point . . . is certainly not Archaic." The same year the Jaketown report appeared I described the cultural succession in Mississippi and indicated that I considered Poverty Point to be post-Archaic (Haag 1955: 87). Willey and Phillips (1958: 157) conclude that Poverty Point must be set aside for further study, and consider it "a developmental enigma."

It would almost appear that all the examples of Archaic in the Lower Valley are about to slip from our grasp, but this is only if we are concerned with a rigid classification scheme. A far more important implication is seen here, namely that the Poverty Point culture is best viewed as transitional from an Upper Archaic tradition to a phase of the Formative. It seems quite justified to employ the terminology of Willey and Phillips in this connection. Although agriculture is the "primary criterion" the stage also has the implication in its content of sedentary village life. With radiocarbon dates for Poverty Point culture ranging from about 1200 to 400 B.C., there is not much reason for doubting that maize was a part of this agriculture, especially in view of the date for maize in northeastern Mexico (MacNeish 1958).

From the foregoing it seems warranted to conclude that Archaic or earlier representations are absent in the Lower Valley of the Mississippi River, at least within all the Alluvial Valley. The surface of the Alluvial Valley is everywhere less than 5000 years old. The Late Archaic materials are represented only if we so classify Poverty Point. In view of the great Archaic occupations known for the Tennessee River Valley from north Alabama to Kentucky, it is remarkable that there is not a closer relationship between that area and the Lower Valley; again the explanation for the absence in the latter region is a geologic one, namely, most surfaces of the Valley that might have been occupied by aborigines during the Archaic period have been removed or buried. Those sites that are classified as Late Archaic are located on old stable beach ridges or near enough to the Pleistocene terraces not to be depressed greatly in the general pattern of subsidence of coastal sediments in the Recent. The greater representations such as the Poverty Point culture are probably transitional from Late Archaic to a Formative. Poverty Point materials may not be expected to be found in quantity along the Gulf Coast of the Mississippi River Delta region.

Byers, D. S.
1959 An Introduction to Five Papers on the Archaic Stage. *American Antiquity*, Vol. 24, No. 3, pp. 229–32. Salt Lake City.

Caldwell, J. R.
1958 Trend and Tradition in the Prehistory of the Eastern United States. *Memoirs of the American Anthropological Association*, No. 88. Menasha.

Collins, H. B.
1927 Archeological Work in Louisiana and Mississippi. *Smithsonian Miscellaneous Collections*, Vol. 78, No. 7, pp. 200–7. Washington.

Fisk, H. N.
1944 Geological Investigations of the Alluvial Valley of the Lower Mississippi River. *War Department, Corps of Engineers, U. S. Army, Mississippi River Commision Publication* No. 52. Vicksburg.

Fisk, H. N. and E. McFarlan, Jr.
1955 Late Quaternary Deltaic Deposits of the Mississippi River. In "The Crust of the Earth," *Geological Society of America Special Paper* No. 62, pp. 279–302. Baltimore.

Ford, J. A. and G. I. Quimby, Jr.
1945 The Tchefuncte Culture, an Early Occupation of the Lower Mississippi Valley. *Memoirs of the Society for American Archaeology*, No. 2. Menasha.

FORD, J. A. AND C. H. WEBB
1956 Poverty Point, A Late Archaic Site in Louisiana. *Anthropological Papers of the American Museum of Natural History*, Vol. 46, Part 1. New York.

FORD, J. A., PHILIP PHILLIPS, AND W. G. HAAG
1955 The Jaketown Site in West-Central Mississippi. *Anthropological Papers of the American Museum of Natural History*, Vol. 45, Part 1. New York.

GRIFFIN, J. B.
1952a Culture Periods in Eastern United States Archeology. In *Archeology of Eastern United States*, edited by J. B. Griffin, pp. 352–64. University of Chicago Press, Chicago.
1952b Prehistoric Cultures of the Central Mississippi Valley. In *Archeology of Eastern United States*, edited by J. B. Griffin, pp. 226–38. University of Chicago Press, Chicago.
1959 Review of "Trend and Tradition in the Prehistory of the Eastern United States," by Joseph R. Caldwell. *American Journal of Archaeology*, Vol. 63, pp. 414–6. Princeton.

HAAG, W. G.
1942 Early Horizons in the Southeast. *American Antiquity*, Vol. 7, No. 3, pp. 209–22. Menasha.
1955 A Prehistory of Mississippi. *Journal of Mississippi History*, Vol. 17, No. 2, pp. 81–109. Jackson.

JENNINGS, J. D.
1952 Prehistory of the Lower Mississippi Valley. In *Archeology of Eastern United States*, edited by J. B. Griffin, pp. 256–71. University of Chicago Press, Chicago.

KELLEY, J. CHARLES
1959 The Desert Cultures and the Balcones Phase: Archaic Manifestations in the Southwest and Texas. *American Antiquity*, Vol. 24, No. 3, pp. 276–88. Salt Lake City.

LEBLANC, J. R. AND H. A. BERNARD
1954 Résumé of Late Recent Geological History of the Gulf Coast. *Geologie en Mijnbouw*, n.s., Vol. 16, No. 6, pp. 185–94. The Hague.

LEWIS, T.M.N., AND MADELINE KNEBERG
1959 The Archaic Culture in the Middle South. *American Antiquity*, Vol. 25, No. 2, pp. 161–83. Salt Lake City.

MACNEISH, R. S.
1958 Preliminary Archaeological Investigations in the Sierra de Tamaulipas, Mexico. *Transactions of the American Philosophical Society*, n.s., Vol. 48, Part 6. Philadelphia.

MCINTIRE, W. G.
1958 Prehistoric Indian Settlements of the Changing Mississippi River Delta. *Louisiana State University Studies, Coastal Study Series* No. 1. Baton Rouge.

MILLER, C. F.
1950 Early Cultural Horizons in the Southeastern United States. *American Antiquity*, Vol. 15, No. 4, pp. 273–88. Menasha.

PHILLIPS, PHILIP
1953 Review of "Prehistory of the Lower Mississippi Valley" by Jesse D. Jennings, and "Prehistoric Cultures of the Central Mississippi Valley," by James B. Griffin. *American Antiquity*, Vol. 19, No. 2, pp. 182–4. Salt Lake City.

PHILLIPS, PHILIP, J. A. FORD, AND J. B. GRIFFIN
1951 Archaeological Survey in the Lower Mississippi Alluvial Valley, 1940–1947. *Papers of the Peabody Museum, Harvard University*, Vol. 25. Cambridge.

RUSSELL, R. J.
1940 Quaternary History of Louisiana. *Bulletin of the Geological Society of America*, Vol. 51, No. 8, pp. 1199–234. Baltimore.
1957 The Instability of Sea Level. *American Scientist*, Vol. 45, No. 5, pp. 414–30. Easton.

SEARS, W. H.
1948 What Is the Archaic? *American Antiquity*, Vol. 14, No. 2, pp. 122–4. Menasha.

SODAY, FRANK
1954 The Quad Site, A Paleo-Indian Village in Northern Alabama. *Tennessee Archaeologist*, Vol. 10, No. 1, pp. 1–20. Knoxville.

WEBB, C. H.
1948 Evidence of Pre-Pottery Cultures in Louisiana. *American Antiquity*, Vol. 13, No. 3, pp. 227–32. Menasha.

WILLEY, G. R., AND PHILIP PHILLIPS
1958 *Method and Theory in American Archaeology*. University of Chicago Press, Chicago.

WILLIAMS, STEPHEN
1957 The Island 35 Mastodon: Its Bearings on the Age of Archaic Cultures in the East. *American Antiquity*, Vol. 22, No. 4, pp. 359–72. Salt Lake City.

LOUISIANA STATE UNIVERSITY
Baton Rouge, La.
June, 1960

STRATIGRAPHY AND SERIATION

JOHN HOWLAND ROWE

ABSTRACT

Stratigraphic interpretation rests on two principles: the principle of superposition and the principle that deposition units can be identified by cultural content. The sequence of deposition units derived from a case of superposition may not give a true cultural sequence if mixing, filling, or collecting has affected the cultural contents of the units. There are two kinds of seriation: evolutionary seriation, done on the basis of an assumed general law of cultural development, and similiary seriation, done on the basis of similarities and differences in objects or deposition units compared. Similiary seriation assumes only that cultural change is normally gradual. Of the two kinds of seriation, only similiary seriation can give credible results. Some evidence of archaeological associations is necessary to control the possibility of non-gradual change resulting from sudden outside influence or archaism. If the conditions for success can be met, either stratigraphy or seriation can provide a credible sequence. Each method provides a check on the other; the most credible results are achieved by combining the two.

A FRIEND whom I regard as an archaeologist of great ability recently remarked that "a properly conducted stratigraphic analysis carries a higher degree of credibility than the best of seriations." I have heard similar statements often enough before so that it seems to me probable that the view expressed has some currency in the archaeological profession.

The statement quoted has the merit of recognizing that there are more and less credible stratigraphic studies and more and less credible seriations. Beyond this point, however, the argument is questionable. I should like to maintain that, within the conditions under which each of the methods is applicable, the right kind of seriation, properly done, carries the same degree of conviction as a good stratigraphic study. Both stratigraphy and seriation have their limitations which must be understood in evaluating results achieved by either method. The general difference, perhaps, is that it is easier to do a bad seriation than a bad stratigraphic analysis.

The principles of stratigraphy were first worked out in geology in the 18th century, and the method was adopted by archaeologists when it was already fully developed. Hence, some of the insights into stratigraphic theory provided by the development of the idea have escaped the attention of many archaeological users of it. Stratigraphic interpretation depends on two principles ("laws"), as pointed out by Stamp (1934: 2–3) and Neaverson (1955: 1):

1. *The Law of Superposition* (Lehmann's principle, 1756). In any pile of deposition units in which the top and bottom of the pile can be identified, the order of succession from bottom to top gives the order of deposition. This principle indicates to the observer the order of particular units in a particular outcrop or site. Its geological application is explained by Dunbar and Rodgers (1957: 110–1, 289). In archaeological work the units observed may be lenses of refuse, buildings, burials, pits and hearths as well as more or less horizontal layers. The first archaeological use of this principle appears to have been made by Thomas Jefferson in 1782 (Jefferson 1787: 156–62; Fraser 1935).

2. *The Law of Strata Identified by Fossils* (Smith's principle, 1796; Fenton and Fenton 1952: 70–83; Adams 1954: 268–76). In a given outcrop or site, the deposition units can be distinguished from one another by contrasts in the features of the fossils or artifacts which they contain and by the frequency with which such features occur. Two deposition units in different sites which contain the same features in the same proportions are assumed to be contemporary. This principle makes it possible to interpret a sequence of deposition units as a sequence of biological or cultural units. The first archaeological use of Smith's principle appears to have been made by Georg Christian Friedrich Lisch in a book review (Lisch 1847).

Superposition alone is not stratigraphy, and the observation of superposition has virtually no archaeological significance unless the cultural contents of the deposition units are contrasted. Jefferson understood superposition, but he had no notion of stratigraphy.

The Law of Superposition has no exceptions, and it is this fact which gives stratigraphy its high reputation for credibility in present day archaeology. There are, however, certain conditions in which the order of deposition of the units at a particular site may not reflect accurately the order of cultural succession.

1. *Mixing of units.* Mixing of units may occur as a result of erosion, plowing, burrowing, or any digging operation which turns over the earth leaving it still in place, such as an earlier

excavation in search of antiquities or building stones. It may also occur as a result of the use of sloppy excavation techniques by the archaeologist. Some mixing of adjacent units inevitably takes place when a site with complex layering is excavated by arbitrary blocks.

There is nothing in the principles of stratigraphy which enables the archaeologist to distinguish mixed units from unmixed ones. The distinction is usually made in one or both of two ways. The first is mechanical. If two fragments of the same object are found at greatly different depths, mixing is strongly indicated. This situation occurred, for example, in some of Wendell C. Bennett's pits at Huari (Bennett 1953: 90). The second method of detecting mixed units is comparative. If certain features which occur together in a deposition unit at one site, or one part of a site, are found to occur separately at other sites or other parts of the same site, mixing in the first case is indicated. It may be impossible to identify mixing in the first excavation in an unknown area.

How seriously mixing affects the stratigraphic interpretation depends on whether the analysis is done in terms of presence and absence of features or in terms of frequencies of taxonomic types. I have contrasted these two approaches in an earlier paper (Rowe 1959). If the analysis is done in terms of presence and absence, the existence of mixed deposition units will prevent the investigator from distinguishing as many successive phases of culture as he would have been able to distinguish with unmixed units. The order of the units that can be distinguished is not affected, however. If the analysis is done in terms of type frequencies mixing may even produce a situation which can be interpreted as giving an order the reverse of the true one.

The best example of a reversal of order attributable to mixing is found in Bennett's excavations at Huari, already cited. Bennett dug 15 pits at Huari, in all of which he found pottery which he classified in four "style groups" of a taxonomic nature: Wari, Ayacucho, Acuchimay, and Huarpa. He only found one of these "style groups" in isolation; that was Huarpa, which occurred by itself in the bottom of his Pit 4 isolated from the rest of the deposit by 50 cm. of "washed stone and gravel" (Bennett 1953: 33). Above this sterile layer all four style groups were found together, and this mixture, in different proportions, was found in all the other pits. In spite of the fact that there was mechanical evidence of mixture in the other pits, as we have noted, Bennett chose to seek indications of sequence in them by calculating the frequencies of the style groups in his arbitrary levels. He also treated the surface collection from the area of each pit as if it were a unit of superposition. All four style groups occurred from top to bottom of the pits, except, of course, in Pit 4, and there was no clear pattern in their fluctuations. However, Huarpa sherds were more frequent in all the surface units than in the levels below, and under the influence of this evidence Bennett decided that Huarpa was the latest of the style groups. This decision forced him to explain the situation in Pit 4 as a case of reversed stratigraphy. Subsequent work in the Huari area by Dorothy Menzel and me in 1958 suggests that the correct order was that given by Pit 4 which Bennett rejected. The associations of styles at other sites indicate that Huarpa must have been earlier than Wari, Ayacucho and Acuchimay rather than later. The situation at Huari which confused Bennett can be explained on the basis of certain peculiarities of Huarpa pottery. This style includes very large bowls with heavily thickened rims, usually having some simple painted decoration around them. Sherds deriving from these rims are almost indestructible and remain on the surface even when plowing and trampling have reduced most other sherds to virtually unrecognizable fragments. It was differential wear, not lateness of date, which made Huarpa sherds so abundant in Bennett's surface collections.

2. *Filling.* A fill is a deposition unit laid down for the purpose of altering the ground level. If the material for the fill is taken from an earlier midden, the result may be a "reverse stratigraphy" in which the cultural order does not correspond to the deposition order (for examples, see Heizer 1959: 328–43). Filling is common wherever monumental architecture is found but may occur even without it. Sometimes the fill differs in texture and structure from undisturbed midden, but fill does not necessarily have any formal distinguishing characteristics. The cultural material in a unit of fill may correspond to a single cultural unit; if it does, the rules for detecting mixing will not necessarily detect filling. Only other evidence of sequence will solve the problem.

3. *Collecting.* We usually make the assumption, in interpreting archaeological associations, that the date of use of an object is, for all practical purposes, the same as its date of manufacture. This assumption may not always be warranted. There are numerous ethnographic examples of the systematic collection and re-use of ancient objects (grinding stones, pottery vessels, jewelry, amulets), and some archaeological examples have been recorded (Lathrap 1956: 24). As archaeological chronologies become more refined we can expect cases of collecting to be identified with greater frequency. It may take work at many sites and very careful attention to stylistic contrasts in order to make a certain identification in such cases.

Mixing, filling, and collecting are situations which set limitations to the effectiveness of stratigraphic analysis as a way of establishing cultural sequences. A single stratigraphic excavation will not provide certainty as to the order of cultural succession unless all three of the limiting possibilities can be definitely eliminated. There are certain sites at which these possibilities can be eliminated, but the degree of certainty attainable depends as much on the situation in the ground as it does on how carefully the stratigraphic analysis is conducted. Stratified sites are rare everywhere, and ones that will yield an absolutely certain cultural sequence are even rarer.

It cannot be emphasized too strongly that the principle of superposition offers absolute certainty only of the sequence of deposition units at a particular site. The cultural sequence for the area may or may not be the same as the sequence of deposition units at the site studied; it will usually take more evidence than can be secured from one stratigraphic excavation to determine the cultural sequence with certainty.

Let us turn now to a consideration of seriation. Seriation is the arrangement of archaeological materials in a presumed chronological order on the basis of some logical principle other than superposition. The units seriated may be individual specimens of a particular kind (pottery vessels, stone axes) or units of archaeological association, such as grave lots or single deposition units of refuse, such as might be found in a "one period" site. The logical order on which the seriation is based is found in the combinations of features of style or inventory which characterize the units, rather than in the external relationships of the units themselves. Hence, seriation involves a detailed study of style and inventory, with attention to the associations of features on individual specimens and in the units of archaeological association.

There are two types of seriation, distinguished by the principles of ordering on which they depend. We can call these types *evolutionary seriation* and *similiary seriation*, the latter term meaning "seriation by resemblance." Evolutionary seriation is done by assuming a universal rule of cultural or stylistic development, such as, for example, that development is always from simple to complex, or that artistic style always develops from realism to conventionalization. The rule which is assumed defines the relevance of the features to be studied and gives both the direction and the order of the development. No points of reference already fixed in time are needed. The credibility of the results depends, of course, entirely on the credibility of the universal rule by which the seriation is accomplished. Unfortunately, none of the rules which have been used so far for evolutionary seriation has any valid claim to universality. If approximately correct results have been achieved now and then by evolutionary seriation, it is no more than a coincidence. Until a rule of development is discovered which really does have universal applicability, evolutionary seriation is nothing but a waste of time.

Similiary seriation is quite a different matter. It is based on the assumption that, within a given cultural tradition, change in culture in general and change in style in particular are both usually gradual processes. On this assumption, objects or cultural units which are close to one another in time can be expected to resemble each other more, at least in certain features, than objects or cultural units which are further apart in time; as General Pitt-Rivers said, "like fits on to like" (Fox-Pitt-Rivers 1875: 308). No assumptions are made about the nature or direction of the changes taking place. This type of seriation was first done by John Evans in 1849 (Evans 1850).

The statement that change in a cultural tradition is usually gradual is one of the most general statements that can be made about human behavior. It appears to be valid within certain limitations which must be understood. There are two types of situations which may lead to sudden and substantial changes in a cultural or artistic tradition: strong outside in-

fluence suddenly felt, and archaism, the deliberate imitation of earlier style or custom. Both of these situations result in change which is not gradual in the sense of the general statement. Since similiary seriation depends on the assumption of gradual change, the credibility of its results depends on our ability to recognize the types of situations which do not fit the assumption, and to do so before or during the process of seriation. We shall come back to this problem after discussing some other conditions for successful seriation.

In order to obtain a sequence by similiary seriation, at least one extreme of the sequence must be known at the start of the project, since no assumption is being made about the order in which changes take place. In the New World the known extreme is often the style or cultural unit which was contemporary with European contact. If we can assume that all phases of the cultural tradition which are later than the time of contact will show some indication of European influence, we can consider that all cultural units which show no signs of such influence are earlier than the phase which we know to be contemporary with contact. The culture of the time of contact then becomes a known extreme from which the cultural units which are assumed to be earlier can be seriated back into the past by arranging them in an order of decreasing similarity to the known extreme. This type of argument enabled Francisco L. Cornely to make a highly credible seriation of five pre-contact cultural units in the Elqui Valley in northern Chile (Cornely 1950, 1956: 79–93).

Under the conditions generally prevailing in the New World, it is usually a safe assumption that cultural units later than the time of contact will show some evidence of European influence. It is not safe to assume, however, that each individual object made after the time of contact will show such influence; not uncommonly relatively few post-contact objects of native manufacture show any European influence at all. Cornely's assumption would therefore not justify an attempt to seriate unassociated objects using European contact as the later extreme of the sequence and identifying the contact by stylistic criteria. When both extremes are known and the materials to be seriated are of such a nature that it is possible to assume that they belong somewhere in the gap we have optimum conditions for a successful and credible seriation.

Another factor which affects the credibility of the results of seriation is the way the ordering is done. Two different methods of seriational ordering are in current use: ordering by type frequency and ordering by continuity of features and variation in themes.

The method of ordering by type frequency is applicable only to refuse deposits and to objects which occur abundantly in refuse; potsherds are usually used. Standard samples are taken from the refuse, usually by collecting all sherds found in blocks of refuse of arbitrary dimensions. The sherds are then classified in formal types, and the frequency of each type is calculated for each refuse sample. Each refuse sample can be considered to be characterized by the presence of certain particular types in certain particular percentages. Ordering is done by arranging the refuse samples in such an order that the frequency of each pottery type shows a pattern of gradual increase to a maximum popularity and then gradual decrease to disappearance. This method should give the correct chronological order of the refuse samples if the following conditions are met:

1. The sherd samples are large enough so that the type frequencies reflect popularity rather than chance occurrence. It may be doubted that a sample of any type consisting of less than ten sherds gives a fair indication of the popularity of the type.

2. The span of time represented by each refuse sample is relatively short.

3. The patterns of frequency in the samples are such that they can be arranged in an order in which there are few sudden jumps. If there are long spans of time not represented in the samples this condition may not be met.

Up to this point I have been assuming that the units being seriated are excavated refuse units, perhaps from a number of different small sites no one of which shows stratigraphic differences. J. A. Ford maintains, however, that surface samples from unexcavated sites can be seriated in the same way as excavated units, and even that a single seriation can be made using both surface and excavated samples (Phillips, Ford, and Griffin 1951: 219–33; Ford 1949). The use of surface samples for type frequency seriation introduces two further assumptions which are not involved in the seriation of excavated refuse units. The first assumption is that the frequencies of types in surface collections are not affected by differences in the nature of the site; for example, that the

surface of a refuse deposit with looted burials in it will give the same type frequencies as a contemporary refuse deposit without burials. The second assumption is that surface sherds are subject to the same kind and degree of "natural selection" on all the sites compared, so that frequencies would not be altered by differences of weathering, plowing, trampling, pothunting, or prior collecting. Ford apparently feels that these assumptions are justified by the fact that his seriation of surface samples from lower Mississippi Valley sites gave nearly the same sequence which Phillips arrived at by stratigraphic analysis. I am not sufficiently familiar with the archaeology of the lower Mississippi Valley to compare field conditions there with those in Peru, where I have worked, but I would certainly be very reluctant to make these two assumptions about Peruvian surface collections in the light of the surface conditions which I have observed at Peruvian sites. The results of Bennett's excavations at Huari, which we have already reviewed, reveal the danger of including both surface and excavated samples in a single seriation.

The second method of seriational ordering now in use is the method of ordering by continuity of features and variation in themes. Because this method is based on observations of presence and absence rather than frequency, it involves fewer sampling problems than the method of ordering by type frequency, and hence it can be applied to a wider range of materials, including rare and unassociated specimens as well as materials found in some kind of archaeological association. The units of discussion are features and themes, defined by contrast in the particular materials to be studied. It is unnecessary, and even undesirable, to use types as the units of this kind of seriation. Continuity of features and variation in themes are two complementary principles of ordering which provide checks on one another and should be used together, although it would be theoretically possible to use either one separately.

Ordering by continuity of features rests on the assumption that the occurrence of features of style in time is not random, but that most features have a continuous span of existence. A feature is introduced, used for a while, and then dropped. Naturally, not all features can be expected to show this ideal pattern of distribution; a feature which has been used earlier in a sequence may reappear because it is reinvented, because it is reborrowed from another tradition, or because its use is deliberately revived. Furthermore, the investigator rarely controls a sample of material sufficiently large to document the complete span of existence of every significant feature. Nevertheless, the assumption that most features will show this pattern of distribution is defensible. In seriating on this assumption the objects or associated lots to be ordered are arranged in that sequence which provides continuous spans of existence for the largest number of features. Since there are always some features which do not show the assumed pattern of distribution, it is important to study enough features so that the exceptions will fall in a minority. Some very inaccurate seriations have been made by archaeologists who were in too much of a hurry and relied on three or four features which turned out to be among those which did not have continuous spans of existence. The larger the sample and the more features studied, the greater will be the reliability of a seriation by continuity of features.

The precision with which an individual specimen can be dated by observing the features associated on it will depend on the number of features the observer is able to distinguish on it and the length of their spans of existence. Generally speaking, the more elaborately a specimen is decorated, the more precisely it can be dated.

In ordering by variation in themes, the investigator selects some complex feature or theme which is found in several variations in the material he is studying, and he makes an arrangement of the variations in order of similarity with reference to the known extremes. In seriating pottery, for example, the profiles of food bowls might be taken as a theme, and the variations in bowl profiles used to establish a tentative ordering. Variations in the proportions of bottle spouts might provide another basis for ordering. If representational or geometric designs are present, variations in some unit of design can be seriated. In Nasca pottery designs, for example, a common figure is a man with an elaborate costume wearing a mouth mask and a forehead ornament. The variations in the way the forehead ornament and the hair are shown have proved to be sensitive chronological indicators for this style.

The important point is that the variations contrasted must be variations on the same

theme, alternate ways of meeting the same technical or artistic problem. It makes no sense to treat one theme as a variation on another; for example, to treat bowls as a variation on the same theme as bottles and ask whether bowls were earlier than bottles or vice versa. The shapes were made for different purposes, and presumably people used both bowls and bottles of some kind at any given time.

A seriation of variations on one theme will give only a tentative order for those specimens or association units in which the particular theme occurs. The variations in other themes must then be studied to see if the tentative order also gives a series of gradual changes for these. Errors in the tentative order are revealed by discrepancies in the seriation of other themes, and the tentative order can be modified accordingly. The more different themes have been studied, the greater the confidence the seriational order merits.

If the seriation is done with specimens which were collected under such conditions that their archaeological context is known, the data of the archaeological associations can be used to relate the sequences of different themes to one another. When a bowl with a certain profile is found repeatedly in grave lot association with a jar with a certain curve in the neck the two varieties must be at least in part contemporaneous, even though they are decorated in very different ways. If the seriation has to be done with unassociated pieces, there will always be some pieces which cannot be seriated, because they do not share enough themes with the pieces on which the seriation is based.

In practice it is usually easier to make the original ordering by studying variations in themes and then to check it by charting the spans of existence of a substantial number of features. A minimum of 100 is recommended. The reverse procedure is also possible, however.

Now we can come back to the problem of the degree to which sudden outside influence and archaism, the situations which do not fit the assumption of gradual change, can be recognized and allowed for in a seriational study. In both cases the problem is different depending on whether the ordering is done by type frequencies or by studying continuity of features and variations in themes.

In ordering by type frequencies, sudden outside influence should be reflected in the sudden popularity of certain new types, probably correlated with an equally sudden decline in the proportion of old types. The same effect would be produced by a gap in the record, however, and there is nothing in the theory of seriation which would guide the investigator to the correct interpretation. Archaism, if it were common enough to show up at all in the sherd counts, would produce a curve showing two peaks of popularity for some of the types. If no allowance were made for the possibility of archaism the investigator would be likely to force certain samples into the wrong place in the sequence.

In ordering by continuity of features and variations in themes, specimens showing sudden outside influence could probably not be seriated in the same sequence with earlier pieces. If the earlier tradition survived at all, however, there would be certain themes discoverable in which gradual change did take place, and these themes could be used as the basis of the ordering. The problem could probably not be handled without some evidence, in the form of archaeological associations, of what kinds of pieces were contemporary with one another.

Archaistic specimens in which the archaism affects only a few features can be identified without much difficulty in ordering by continuity of features if enough features are studied. Such specimens can also be distinguished in some cases by the presence of anomalies in the combinations of theme variations they show. Really good imitations of earlier pieces cannot be identified by seriational methods alone, but they can be detected readily enough if archaeological associations of contemporaneity are available.

We can conclude that both methods of ordering are vulnerable to errors resulting from sudden outside influence and archaism, but that the difficulties can be avoided in the method of seriation by continuity of features and theme variation by checking the seriational order against archaeological associations of contemporaneity, such as grave lots or deposition units of refuse.

To sum up the comparison of stratigraphy and seriation, it appears that there are several different ways of doing both, and that the chances of attaining credible results depend on the nature of the archaeological evidence available, the alternative method chosen, and the degree to which the theoretical limitations of the method are kept in mind in the course

of the work. There is one type of seriation, namely similiary seriation in which the ordering is done by continuity of features and theme variation, which can give results fully as credible as the best stratigraphic analysis, provided that associations of contemporaneity are used as well as unassociated specimens.

If the investigator has the time and the choice, he can profitably combine the methods by excavating a stratified site, making a stratigraphic analysis of the materials found, and then doing a parallel seriational analysis of the same materials. Since the limitations of the two methods are different, each provides a check on the other. If the results agree, the maximum credibility has been attained.

The common belief that stratigraphic analysis always gives more credible results than seriation rests in part on misunderstanding of the limitations of the two methods, in part on the professional bias of most archaeologists in favor of settling all problems by excavation, and in part on the fact that examples of deficient seriational studies come readily to mind. Our review does not confirm this common belief, but it does suggest that there may be more different ways to be wrong in seriation than there are in stratigraphic analysis.

Acknowledgments. This paper is a by-product of research on Peruvian archaeology being carried out on a grant from the National Science Foundation, and the Foundation's support is gratefully acknowledged. Many of the ideas presented are the product of discussions with Dorothy Menzel, Edward P. Lanning, Lawrence E. Dawson, Dwight T. Wallace, Eugene A. Hammel, and Donald W. Lathrap, and I have been influenced by their research experience as well as my own. A shorter version of this paper was read at the 4th Annual Meeting of the Kroeber Anthropological Society, Berkeley, May 21, 1960.

Adams, F. D.
1954 *The Birth and Development of the Geological Sciences.* Dover Publications, New York.

Bennett, W. C.
1953 Excavations at Wari, Ayacucho, Peru. *Yale University Publications in Anthropology,* No. 49. New Haven.

Cornely, F. L.
1950 Prehistoria del territorio Diaguita chileno (provincias de Coquimbo y Atacama). *Publicaciones de la Sociedad Arqueológica de La Serena, Boletín,* No. 5, pp. 3–18. La Serena.
1956 *Cultura Diaguita chilena y cultura de El Molle.* Editorial del Pacífico, Santiago.

Dunbar, C. O., and John Rodgers
1957 *Principles of Stratigraphy.* John Wiley and Sons, New York; Chapman and Hall, London.

Evans, John
1850 On the Date of British Coins. *The Numismatic Chronicle and Journal of the Numismatic Society,* Vol. 12, No. 4, pp. 127–37. London.

Fenton, C. L., and M. A. Fenton
1952 *Giants of Geology.* Doubleday, Garden City.

Ford, J. A.
1949 Cultural Dating of Prehistoric Sites in Virú Valley, Peru. *Anthropological Papers of the American Museum of Natural History,* Vol. 43, Part 1, pp. 29–89. New York.

Fox-Pitt-Rivers, A. H. L.
1875 On the Principles of Classification Adopted in the Arrangement of his Anthropological Collection, now Exhibited in the Bethnal Green Museum. *The Journal of the Anthropological Institute of Great Britain and Ireland,* Vol. 4, pp. 293–308. London.

Fraser, A. D.
1935 Thomas Jefferson as Field Archaeologist. *The Four Arts,* Vol. 2, No. 3, pp. 3–4, 15. Richmond.

Heizer, R. F. (editor)
1959 *The Archaeologist at Work; A Source Book in Archaeological Method and Interpretation.* Harper and Brothers, New York.

Jefferson, Thomas
1787 *Notes on the State of Virginia,* second English edition. John Stockdale, London.

Lathrap, D. W. (editor)
1956 An Archaeological Classification of Culture Contact Situations. In "Seminars in Archaeology: 1955," edited by Robert Wauchope, pp. 1–30. *Memoirs of the Society for American Archaeology,* No. 11. Salt Lake City.

Lehmann, J. G.
1756 *Versuch einer Geschichte von Flötz-Gebürgen, betreffend deren Entstehung, Lage, darinne befindliche Metallen, Mineralien und Fossilien. . . .* Klütersche Buchhandlung, Berlin.

Lisch, G. C. F.
1847 Der Verein für Lübeckische Geschichte. *Allgemeine Zeitschrift für Geschichte,* Band 7, pp. 377–81. Berlin.

Neaverson, Ernest
1955 *Stratigraphical Palaeontology; A Study of Ancient Life Provinces,* second edition. Clarendon Press, Oxford.

Phillips, Philip, J. A. Ford, and J. B. Griffin
1951 Archaeological Survey in the Lower Mississippi Alluvial Valley, 1940–1947. *Papers of the Peabody Museum, Harvard University,* Vol. 25. Cambridge.

Rowe, J. H.
1959 Archaeological Dating and Cultural Process. *Southwestern Journal of Anthropology,* Vol. 15, No. 4, pp. 317–24. Albuquerque.

Stamp, L. D.
1934 *An Introduction to Stratigraphy (British Isles),* second edition. Thomas Murby & Co., London.

University of California
Berkeley, Calif.
April, 1960

ELABORATION AND INVENTION IN CERAMIC TRADITIONS *

ROBERT L. RANDS

ABSTRACT

A significant working difference between the mode and type is seen to lie in the greater tendency of the former to reappear on different time levels. In part, this is because more opportunity exists for the chance reduplication of an isolated feature than for a group of integrated attributes. Consideration of the flange-and-ridge and the everted-rim traditions in Maya ceramics focuses attention on additional factors which may help to account for the reappearance of modes. The possibility is recognized of refuge zones where traits continued, later to diffuse back to the centers of the investigation. Primary theoretical consideration is given to the modification of traits through the elaboration of traditions and the possibility that this process sometimes led to the reinvention or resurgence of once popular forms. Such a process is based on the potter's wish to create something slightly different while working within the technico-stylistic bounds of a tradition. This may occasionally lead to a recombination of elements that approximate older forms (low level reinvention) or to a twist that imparts fresh interest to a dying form — hence renewed recognition of the mode by the investigator following its complete disappearance in his archaeological samples.

THE MAJORITY of ceramic attributes, if taken singly, are generally recognized to be of limited temporal value. Instead, archaeologists have turned primarily to a combination of the more diagnostic attributes. These are sometimes linked under the concept of type, either as they tend to cluster in whole artifacts (Newell and Krieger 1949) or, more commonly, as a selected range of the attributes may be observed to recur in potsherds. Again, individual features may be studied without establishing types (Rowe 1959) or concurrently with a typological framework (Rouse 1960; Phillips and Gifford 1959). Even when the attributes are treated without reference to typology, however, "the association of features on a single specimen and the association of features on different specimens . . . that . . . can be regarded as contemporaneous" remain of critical importance (Rowe 1959: 321). Rouse (1960: 320) has taken the position that while historical types are the most suitable unit for dating cultures and defining local culture periods, modes — "whether used singly or in combination" — tend to be more useful in establishing chronology on a regional, multi-area basis. As Rouse makes clear, this is because modes usually have a broader geographical distribution than types. Granting that we must make the best of the situation and use the evidence even of single modes, the problem of how they are to be interpreted in cultural reconstruction remains a significant one.

It is true that certain modes have considerable chronological value in their own right. A well-known example from the Maya area is the basal flange, which has strong connotations of an Early Classic horizon. The fact that examples occur in later times in the Alta Verapaz (Smith 1952) and Postclassic Quintana Roo (Sanders 1960, Fig. 4 c) is to be regarded as the exception to the rule, perhaps not too surprising when one considers the vagaries of many other ceramic attributes, but out of keeping with our traditional interpretation of Maya ceramic history. Often, some relatively minor difference within the more generalized feature can be distinguished as a basis for chronological refinement. Thus in the Maya area, the notched variety of basal flange tends to be of Tepeu 2 date. Or the feature occurs in a slightly different context; on at least one of the Late Classic Chipoc (Alta Verapaz) basal flange vessels (Smith 1952, Fig. 13 m), the unnotched flange is placed considerably closer to the bottom of the vessel than would be true on the typical Early Classic specimens. Even within a mode having a restricted position in time and space, however, the range of variation may be greater than the differences which set apart the more distantly related modes. Accordingly, the investigator cannot classify successfully on the basis of modes that have been defined too closely. Allowance must be made for range of variation, for the freedom of play that is inherent in craft production.

Once this allowance has been made, the comparison of the somewhat broadly conceived modes has its pitfalls, if the investigation is directed toward chronological refinement or establishing direct areal relationships. Nevertheless, participation in traditions of a generalized nature may be revealed. The following remarks are directed toward such mode traditions. Attention will be paid to the more precise forms and contexts taken by general-

* Presented at the 25th Annual Meeting of The Society for American Archaeology, New Haven, May 7, 1960.

ized modes as they are subject to long-continued elaborative treatment. In addition to the distinctive temporal patterns that emerge, the succeptibility of mode traditions to revert to forms which had an earlier popularity will be examined. To clarify, the ceramic context of the mode has not been duplicated, and if one exposes the feature itself to close scrutiny, it will be possible to find at least slight differences in treatment between the earlier and later forms. Nevertheless, a tendency toward reasonably close approximation of earlier forms is significant not only to the problem of effective classification on the basis of modes but to broader problems of cultural process.

Theoretical Statement

The concept of "pattern elaboration" has been advanced as an explanation for the occurrence of certain ethnological traits that have a discontinuous distribution in space (Rands and Riley 1958). It would also appear that the concept offers a useful approach to certain ceramic traits that have a spotty distribution in time, being present in some locale, or in closely adjacent regions, on different chronological levels.

The general concept of pattern elaboration has deep roots in anthropological theory. The term directs attention to the tendency for culture change to take place as a series of minor modifications which serve to embellish some trait or trait-complex already present in the cultural background. The explanation for this is that man is a creature of habit, deriving emotional stability from the predictability of behavior provided by cultural patterns. At the same time man is subject to boredom.

> The presence of patterns provides a way out of this impasse; for, acting in accordance with socially accepted norms, the restless individual, the innovator and inventor, is able to follow out the potentialities of a pattern. Thereby, a series of minor changes is made that has a consistent relationship to the previously existing culture (Rands and Riley 1958: 275).

On the level of material culture, this tendency is well exemplified in Bunzel's classic description of Pueblo pottery making. Repeatedly, informants maintained that their work — and that of other potters — was distinctive and original. Typically they would assert (Bunzel 1929: 52):

> I like all kinds of designs. My jars are all different. I don't make the same design twice.
>
> I never copy the designs of other women. It is not right to do that. You must think out all your designs yourself. Only those who do not know copy.
>
> When I first started to paint, I always used the designs from the old pottery, but now I sometimes make up new designs of my own. I always think about pottery even when I am doing other things. When I dream about designs, I paint them the next day. Whenever I close my eyes, I see the designs right in front of me. When I dream about designs, they are always new designs. When I am ready to paint, I just close my eyes and see the design and then I paint it. . . . Every woman paints differently.

Bunzel (1929: 53) adds significantly:

> A woman in all sincerity reproduces a familiar type of ornament, believing it to be something derived from her own consciousness. . . . She is puzzled and somewhat chagrined to have it pointed out that she has used three designs on the jar, although she has frequently expressed a decided preference for four designs. She can offer but one explanation: "We always use three when we make this design." . . . She is also much interested to have pointed out to her that the particular rim design chosen is invariably used with this body design and one other of similar character, but is never used in association with the very different deer and sunflower design. "Yes, that is right. We always do it that way, but I never thought about it before."

There is, then, a strong limitation of decorative content and arrangement imposed upon the potter. Within the limits of the style, however, there may be a great deal of manipulation, resulting, as Bunzel says, in "an unfailing freshness and variety of design." Hopi women "constantly invent new patterns, or rather new variants of . . . patterns, because it is as easy as painting the old ones and very much more enjoyable" (Bunzel 1929: 57). The term "elaborating tradition" — "the addition [or sometimes substitution] of traits or attributes which are integrated in a single line of development" (Thompson 1956: 44) — aptly describes this process.

In contrast, large-scale innovations which depart radically from extant patterns appear to be comparatively infrequent, especially in the technologically simple world with which the archaeologist is normally dealing. Even when a trait is diffused, it will often consist of little more than a variation of a basic trait-complex which was already shared by the recipient and donor societies. The assimilation of the diffused trait will frequently result in a further minor modification. Add to this the fact that the modification in the shared tradition will sometimes be made internally — that Bunzel's informants regarded themselves as constantly creating new

artistic concepts, even though the designs look highly similar to the outsider — and the great opportunity for pattern elaboration to take place, at least in some ceramic attributes, is apparent.

If this is granted, it follows that there will be many traditions which are constantly undergoing minor changes in a variety of adjacent societies and over a considerable time span. Some of the elaborations will be fairly distinctive. But, because the various innovators are drawing on the same basic technico-stylistic pool of ideas and materials, there is a possibility that some of them will happen upon the same or closely corresponding modifications. Elaborating inventions will have been made independently of one another but, having stemmed from the same tradition, they will retain a genetic historical relationship.

In some traditions the modifications will be cumulative. As small innovations are added, the tradition will become more complex. In the course of time, the potentialities for effective manipulation of the tradition through new elaborations will have changed. This is to say that the tradition will have shown a significant drift away from its original form. Under such circumstances, it is unlikely that independent modifications of the tradition, made at widely separated times, will show many really close similarities. The tradition has too little in common at these different points in time.

On the other hand, the minor changes to which certain traditions are subject will be in the nature of substitutions, rather than accumulations. A new fad will arise to give variety to the tradition, replacing an old, once virile embellishment. This may sometimes result in a cyclical phenomenon: women's skirts alternately become longer or shorter. If the nature of the attribute or basic trait-complex is not too restrictive, a fairly large range of elaborations, one of which might substitute for any of the others, is possible. Under these conditions, cyclical recurrences of a particular elaboration would not be expected, although the embellishment in question might well arise more than once, perhaps even at irregular intervals during the history of the tradition.

It may be questioned whether such substitutive changes merit the name of "reinvention." These are certainly not innovations on the order of Linton's "basic invention" (Linton 1936: 316), nor do they normally represent a very high magnitude of elaboration. Willey, in correspondence, speaks of the "re-sorting or re-shuffling of limited possibilities for culture change" in conservative traditions and poses the question, "Is this because no real change is allowed so that human creativity must 'fiddle' with meager trivia?"

Needless to say, the two sorts of elaborating traditions which have been recognized — cumulative and substitutive — are ideal types. Most traditions which elaborate probably show both characteristics, although in varying proportion. The ceramic traditions with which this paper is concerned are basically substitutive, given to the fads which come and go without greatly altering the nature or complexity of the tradition.

SUBSTANTIVE DATA

Two examples follow of ceramic traditions which achieve a sense of variety through the substitution of one feature for another fundamentally similar one. Both examples are from Maya ceramics. Both are "shape traditions" in the terminology of the Society for American Archaeology Seminar on Cultural Stability (Thompson 1956: 42). As such they are extensions of Willey's (1945) original formulation of the "pottery tradition," which was defined in terms of basic techniques of ceramic decoration. Nevertheless, the shapes in question have essentially decorative functions. Accordingly their behavior — the changes to which they are subjected — may have much in common with more purely decorative ceramic features.

The examples may be termed the "flange-and-ridge" and the "everted-rim" traditions. The latter may in turn be related to a more generalized pattern of rim embellishment. Both the flange-and-ridge and everted rim were established in Preclassic (Formative) pottery, not only in the Maya area but elsewhere in Mesoamerica (Wauchope 1950: 232, Figs. 1–3, 10, 11). Within the Maya area, their subsequent history was quite distinct. The flange-and-ridge tradition underwent intensive elaboration, especially in the Petén, during the Protoclassic, Tzakol, and Tepeu phases. Rims having as wide an eversion as those of the Preclassic suffered virtual extinction in most of the Maya area, and in the well-known Classic pottery of the Petén pronounced rim elaboration of any kind was quite rare. However a continued interest in rim eversion, often combined with thickening, is evidenced in Yucatán (Brainerd

1958). Everted rims have some importance at Piedras Negras (Butler 1935, Pl. 8 38, 39) and occur in other Late Classic pottery (Butler 1940, Fig. 22 *f*; Smith 1955b, Fig. 1 *g*, *h*). As will be seen, this feature constituted a major focus for elaboration in the pottery of Palenque, in northeastern Chiapas.

The flange-and-ridge tradition is characterized by horizontal moldings of clay, encircling the vessel and jutting out from its walls. Brainerd (1958: 48) differentiates between ridges ("small, with cross section approaching an equilateral triangle"), flanges ("considerably higher than are ridges, [with] their sides . . . less convergent, and the apex more blunt"), and skirts ("a form similar to flanges or ridges but . . . [projecting] almost directly downward from the vessel"). Size and position of the projecting molding varies, but for the most part the feature occurs on low bowls and dishes; often it helps to define the angle between upper and lower zones of composite silhouette vessels.

The precise form taken by the flange or ridge, together with its position on the vessel, has considerable diagnostic value for chronological purposes. Figure 1 shows the development of the flange-and-ridge tradition at Uaxactún, in the central Petén. Phase names are given, early on the bottom to late at top. It will be noted that the segments of the wall profiles which are shown are distinctive enough, and this appearance would be even more pronounced if profiles of the entire vessels were shown. Our present concern, however, is with the flange or ridge in its immediate context — a context which is familiar enough to the archaeologist working with sherd material. Unlike the archaeologist sorting on the basis of a combination of attributes, however, we are concerned here solely with the intrinsic quality of shape considered as a mode.

In the well-known Uaxactún sequence, the flange appeared first in the Chicanel phase, being located either at the rim as a *labial flange* (Fig. 1 *h*) or a short distance below the rim as a *lateral flange* (Fig. 1 *i*). The *lateral ridge* was a similar but less-projecting form (Fig. 1 *j*). Later, in the Tzakol phase, the flange tended to drop somewhat lower on the vessel, although this lowered position was anticipated elsewhere in Protoclassic pottery (Merwin and Vaillant 1932, Pl. 18 *b*). The resultant *basal flange* (Fig. 1 *e*) characteristically occurred at a point where the wall changes direction, in this respect differing from some although not all of the earlier lateral-flange vessels (Smith 1955a, Fig. 16 *f*, 1–3). Further, basal flanges were usually larger and more downward-pointing; rather than forming a simple ridge, the molding was set out from the vessel wall. A number of elaborative treatments are, then, involved in the basal flange, although historical relationship to the Chicanel lateral flange is apparent. Resemblances also extend to the *sharp Z-angle* on composite silhouette bowls of the Tzakol phase (Fig. 1 *f*) and, less strongly, to Chicanel examples of the Z-angle, placed high on the vessel wall (Smith 1955a, Fig. 16 *f*, 4).

Smith's Tepeu 1 subphase witnessed the disappearance of the basal flange at Uaxactún. Ridges became smaller and sometimes shifted upward to a position on the vessel wall approximately that of the Chicanel lateral flange. Allied Tepeu forms are known as the *basal ridge* (Fig. 1 *b*) and *lateral ridge* (Fig. 1 *c*). One would never confuse lateral-ridge sherds

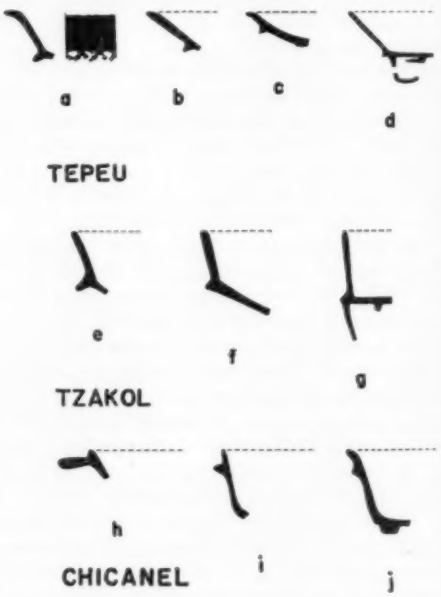

Fig. 1. Flanges and ridges at Uaxactún, after Smith 1955a. *a*, notched basal flange (Smith, Fig. 37 *a*, 8); *b*, basal ridge (Smith, Fig. 36 *a*, 12); *c*, lateral ridge (Smith, Fig. 36 *b*, 2); *d*, sharp Z-angle (Smith, Fig. 51 *d*, 1); *e*, basal flange (Smith, Fig. 25, *a*, 2); *f*, sharp Z-angle (Smith, Fig. 31 *a*, 2); *g*, sharp Z-angle (Smith, Fig. 21 *a*, 5); *h*, labial flange (Smith, Fig. 70 *b*, 8); *i*, lateral flange (Smith, Fig. 70 *a*, 45); *j*, lateral ridge (Smith, Fig. 16 *f*, 1). Approximate scale 1:7.

with lateral-flange Chicanel examples, but an important part of the differentiation would be on the basis of factors other than the nature of the flange or ridge itself (for example, sorting criteria would include slip, temper, presence or absence of polychrome design, and the angle of the vessel wall). In addition, the lateral flange or ridge of Chicanel times tends to be somewhat larger than the Tepeu 1 lateral ridge. In spite of these differences, however, a partial duplication of the mode treatment does take place.

Following its apparent absence at Uaxactún in the Tepeu 1 subphase, the basal flange reappeared in Tepeu 2. Its treatment, however, was altered, the flange being characteristically notched or stepped and often somewhat smaller in size than in the Early Classic period (Fig. 1 *a*). One suspects that the basal flange may have continued in use elsewhere in the Maya area during times equivalent to Tepeu 1, and perhaps the Tepeu 1 subphase was of limited duration at Uaxactún. Under such circumstances, the history of the basal flange would have been unbroken, the Tepeu 2 notched-and-stepped variety being an indirect outgrowth from the Tzakol form. However, the re-emergence of the basal flange with a new elaborative treatment, following its virtual extinction or at least serious drop in popularity, remains a possibility. Such a history, it may be noted, would differ from the classic uni-modal approach to the waxing and waning of pottery types (Phillips, Ford, and Griffin 1951: 219–23). In the case of the basal flange, however, we are dealing not with several distinct attributes which combine into a type, but with a smaller number of variables which express the elaborative play of a mode-based tradition. Under such circumstances, one might suspect that an almost discarded treatment could gain new popularity if it were accorded some different twist, thereby halting, at least temporarily, the apparent trend of a dying form. Perhaps this would happen less frequently in the case of a pottery type, but conclusions are premature in the absence of investigations directed toward such problems.

In any case the notched Tepeu 2 flange had an early forerunner in Uaxactún ceramics, for certain examples of the Chicanel lateral flanges were also notched (Smith 1955a, Figs. 70 *a*, 49, 51; 77 *b*, 3, 4). Flanges were variously decorated in intervening times by painting, incising, and grooving (Smith 1955a: 135, Figs. 20 *a*, *c*, *e*, *n*). A direct outgrowth of the Late Classic notched flange from that of the Preclassic seems improbable, although the occasional segmented Z-angles of the Tzakol phase could have provided a flange-like medium on which to carry the tradition of notching. Nor is it difficult to visualize, at different times and places, the more fully independent application of notching, as one of many available decorative techniques, to the eye-catching surface provided by the flange.

Tzakol cylindrical tripods at Uaxactún sometimes bear a triangular molding at the point of juncture of vessel wall and essentially flat base (Fig. 1 *g*). This is one example of Smith's (1955a) sharp Z-angle. The sharp Z-angle also appears in basal position on Tepeu 3 tripod plates at Uaxactún, apparently being absent in the Tepeu 1 and 2 subphases. The Tepeu 3 Z-angle is usually notched (Smith 1955a, Fig. 51 *d*). The sharp Z-angle that is often notched or otherwise segmented occurs widely on flat-base tripod plates on the same horizon, without known antecedents, and seems a good horizon marker for the Maya area (Smith 1955a: 193; Brainerd 1958, Fig. 58; Berlin 1956, Fig. 4 *w*, *x*). Again we are faced with the questions posed in connection with the basal flange: did the feature continue without interruption in some as yet unknown area, or was there a resurgence or reinvention of the trait? It is fairly well represented in Puuc Slateware. Perhaps significantly, the unsegmented basal Z-angle occurs abundantly at Palenque and in the greater Palenque area, but there, too, it is confined to a horizon approximate in time to Tepeu 3 (Fig. 2 *d*, *e*; Rands and Rands 1957: 143). Although a more detailed knowledge of regional Maya ceramics is imperative, consideration must be given to the possibility that the sharp basal Z-angle as a particular expression of the flange-and-ridge tradition was hit upon independently, on both Early and Late Classic time levels.

As previously noted, the flange was frequently found at the break in composite silhouette bowls and was intimately associated with this vessel form. The basal flange served to demarcate zones of decoration on the vessel exterior, a single relatively broad panel appearing above the flange during early Tzakol times and a more narrow panel, with the flange also subject to decoration, characterizing the latter part of the phase. In such ways, the flange

functioned in a wider context than is indicated by its treatment as part of the flange-and-ridge tradition. A drop in popularity of composite silhouette vessels, or a shift of design from restricted panel arrangements to some other composition such as the broader field provided by cylindrical vases, would have affected the incidence of the basal flange, contributing to its decline. Similarly, factors which might have provided a background favorable to renewed growth in popularity of the basal flange must be sought outside the flange-and-ridge tradition. Turning to the sharp basal Z-angle, it is apparent that this form would have had its greatest opportunity to occur at those times in which flat-based vessels were popular.

The problems which have been posed in regard to the elaborative development of the flange-and-ridge tradition may be restated. Did the various partially-corresponding to closely-similar mode forms have an unbroken history, perhaps dying out at Uaxactún but actually surviving in as yet unexplored regions and giving rise to new features, which subsequently diffused back to Uaxactún? Or did at least some of these forms suffer complete extinction, later to be reinvented in new ceramic contexts somewhere in the Maya area? In some instances a middle ground may be reached: the forms may have declined in popularity to the point where they are not revealed in the archaeological record, but some new treatment served to give them renewed vitality. Needless to say, the answers to these questions cannot be reached simply on the basis of the Uaxactún materials. The present preoccupation with that site is in recognition of its extraordinarily complete ceramic record and is for the purpose of focusing on specific problems of limited scope. Suffice it to say that the pottery of San José, so similar to that of Uaxactún in many respects, shows the same succession of lateral flanges (San José I), basal flanges (San José II), and lateral ridges (San José III) (Thompson 1939, Fig. 93), with sharp basal Z-angles occurring at the close of the Classic sequence (Thompson 1939, Fig. 80 *c*), and that a similar tendency toward notched and segmented flanges and ridges occurs on various time levels (Thompson 1939, Figs. 27 *e*, *h*, 28 *f*, 69 *c*, 80 *c*). Consideration of the pottery of Yucatán would, of course, show greater variation. Analysis of the flange-and-ridge tradition there lies beyond the scope of these exploratory remarks. It is interesting, however, to note examples of the sharp basal Z-angle in Formative stage Flaky Redware from Chichén Itzá (Brainerd 1958, Fig. 4 *o*, *19*) and Tancah Red from Quintana Roo (Sanders 1960, Fig. 9 *b*, 59), thus extending and intensifying the erratic chronological position of this mode.

The everted-rim tradition in Maya pottery is characterized by a more or less pronounced eversion of the rim exterior. The treatment occurs mostly on low flaring-walled vessels (dishes and plates), but extends to other forms. The rim may jut horizontally from the vessel wall, or it may tilt upward or downward. Sometimes it is thickened. Actually, rim thickening involves another traditional approach to pottery manufacture, and in such forms as the bolster rim of Yucatán Slateware (Brainerd 1958) the eversion that occurs may be the functional result of the sharply increased width at the rim (the alternative would be interior rim thickening). On the other hand, merging of two originally distinct traditions of rim elaboration, eversion and thickening, is a possibility in a number of examples of thickened everted rims (compare the "converging tradition" in Thompson 1956: 44). A discussion of the varied occurrences of rim eversion throughout the Maya area is beyond the scope of the present paper. Comparisons will largely be confined to everted rims on Preclassic pottery and at the important Classic site of Palenque, where rim eversion continued as a dominant aspect of the local ceramics (Fig. 2).

Widely everted rims constituted an important feature of Preclassic Maya pottery. The upper face of the rim was frequently grooved or incised, and protrusions sometimes extended out from the rim, forming a wavy or scalloped outline. At Uaxactún, wide everted rim plates occurred in the Mamom and, especially, Chicanel phases. Recently published materials from Yucatán (Brainerd 1958, Figs. 16 *a*, *d*, 17 *h*, 31 *c*, 65 *c*), Quintana Roo (Sanders 1960, Fig. 9 *b*), and Chiapa de Corzo (Dixon 1959) add to the distribution of wide everted rims given by Smith (1955a: 114, 120, 124).

Wide everted rims are also present in the extremely small amount of ceramic material recovered at Palenque which may be related to the Preclassic period. Slightly upturned rims, plain or grooved and incised, offer close formal

FIG. 2. Everted rims at Palenque and in Preclassic Maya pottery. *a–l*, Palenque; *m*, *n*, Maní (after Brainerd 1958, Fig. 31 *a*, *22*, *16*); *o*, Chiapa de Corzo (after Dixon 1959, Fig. 6 *c*); *p*, *q*, Uaxactún (after Smith 1955a, Fig. 16 *c*, *3*, *7*). Approximate scale 1:8.

correspondences to Chicanel materials (Fig. 2 *j*, *l*, *p*, *q*). Rims with less pronounced eversion also occur on an early level at Palenque (Fig. 2 *k*) and, in modified form, have a long history at the site (Fig. 2 *l*, *d*). Meantime, wide everted rims disappear from the archaeological record at Palenque, becoming either extinct or so unimportant numerically that the history of this mode has clearly suffered a serious disruption.

The disappearance of the wide everted rim was not to prove permanent, however. By times equivalent to Tepeu 1 or 2 the form had attained, or regained, great popularity. The dating is demonstrated stratigraphically and by the presence of wide everted-rim tripods placed as offerings in the Inscriptions tomb (Fig. 2 *h*), that is, securely associated with a probable date of 9.13.0.0.0 (Ruz Lhuillier 1955: 94). The wide everted rim was no longer grooved or incised, instead often occurring with polychrome interior—red-and-black-on-orange, with a cream primary slip and over-all orange finish. In spite of the intervening centuries, the shape of these wide everted rims corresponds closely to many Preclassic Maya examples (compare Fig. 2 *g*, *n* and 2 *h*, *o*). The resemblance extends even to the precise place and contour of rim thickening, approximate ratio of rim eversion to vessel height, and approximate slope of outflaring vessel walls. These similarities, while incidental to the mode of rim eversion, contribute to the effect of sameness. By the terminal Late Classic phase at Palenque, wide, horizontally-everted rims on tripod plates had died out, their place being taken by down-tilted rims with slightly less pronounced eversion (Fig. 2 *e*). Similar forms are known not only in the approximately contemporaneous Florescent Medium Slateware in Yucatán (Brainerd 1958, Fig. 47 *b*, *c*, *g*) but in the temporally-remote Holactún and Maní Formative monochromes (Fig. 2 *m*). In view of the stratigraphic evidence, the simplest explanation seems to be that the potters who made the Palenque tripods held everted rims to be a desirable treatment, and in their experimentation they hit upon certain shapes that closely duplicated favored forms of the Preclassic period.

Horizontal rim eversion, although used only sparingly on the tripod plates at Palenque during the final phase (Fig. 2 *d*), extended to new vessel forms at the site. Deep utility basins began to show and elaborate this feature (Fig. 2 *b*, *c*). In some cases incensarios, both pedestal-base and ladle-handle (Fig. 2 *a*), also shared this treatment. It is as if the tradition of horizontal eversion, having run its course on the tripods, was picked up and incorporated in other ceramic contexts.

Occurrences of the wide everted rim were probably conditioned by function as well as by the manipulative play of the potters. The projecting rim may have served as a means of lifting. Especially on vessels of large diameter, the wide rim would provide a useful place to grasp and steady the container. Orifices of Palenque pottery tended to be wider than those in the Petén, and it is possible that this tradition of wide mouths, which may have been maintained from Preclassic times, gave a usefulness to rim eversion at Palenque which was largely lacking in Classic Petén pottery. Moreover, the exterior of wide-mouth vessels was usually plain at Palenque, and some form of elaborative rim treatment, including wide rim eversion, gave a decorative effect to what otherwise would have been a large, monotonous field. Such extraneous considerations would seem to provide an ideal background for rim

elaboration, increasing the possibility that the wide everted rim would be employed at various times and with different types. However, the late occurrence of wide everted rims on a variety of vessel forms at Palenque may be related to a general tendency for culture traits to become increasingly disassociated from their original function, being perpetuated, as random variations on a theme, even when no strictly utilitarian purpose is served.

Discussion

Other things being equal, it is apparent that a combination of modes has greater diagnostic value for dating purposes than do isolated ceramic attributes. The odds against the independent occurrence of a group of modes are obviously greater than for the reduplication of a single feature. However the tendency of some modes — or close approximations of the same mode — to occur on distinct, non-sequential time levels requires a further basis in theory. The explanation advanced here stems from the observed fact that some traditions are subjected to intensive manipulation. The specific changes that result are usually quite minor, as human conservatism and the nature of the tradition combine to limit the effective range of socially accepted innovations. Nevertheless, frequent creativity can take place within this framework. The limitations remain essentially constant when fads come and go without basically changing the nature of the tradition (the substitutive type of elaborating tradition). The greatest opportunity for the reinvention or resurgence of once-favored forms would appear to exist under these conditions.

Such a pottery tradition is apt to be given many new embellishments over a number of generations and in the adjacent regions where it is shared. These elaborating inventions will usually differ from one another. But if the limitations inherent in ceramic materials and in the tradition itself are stringent, the potters, in their attempts to create something slightly different, will sooner or later be likely to approximate some form which had been present in earlier days. This cannot be considered a classic example of independent invention, for other component parts of the tradition had diffused back and forth, providing the setting and inspiration for the reinvention of the earlier trait. Interest in some broader pattern or traditional approach had never died out, being perpetuated through a series of specific mode forms. Nor is this what anthropologists normally have in mind when they trace the distribution of culture elements through time and space. It is akin to Kroeber's stimulus or idea diffusion, but on a microcosmic rather than remote, areally-distinct level. Kroeber's remarks about Chinese and Japanese algebra, with their proved connection, are especially pertinent, as he speaks of "the awakening of the idea or method, its revivification, one might almost say its reinvention. . . ." (Kroeber 1940: 11).

From this theoretical point of departure, local sequences showing flange-like projections and rim eversion have been examined in Maya ceramics. Related forms are designated, respectively, the "flange-and-ridge" and "everted-rim" traditions, the former being discussed primarily in terms of the pottery of Uaxactún and the latter in terms of Palenque pottery. Inevitably, results are somewhat inconclusive. Certain expressions of these traditions did indeed occur on different horizons, apparently making a reappearance after the lapse of considerable time. With our present sketchy knowledge of Maya ceramic history, it is impossible to demonstrate that the specific forms died out completely. Conceivably, they may have been perpetuated in some as yet unknown region, subsequently diffusing back to Uaxactún or Palenque. Or they may have suffered so heavy a decline at these sites as to have escaped notice in the ceramic samples, only to gain renewed popularity (hence archaeological recognition) at a later period. In any event, the substantive data are consistent with the theory of reinvention; in some cases this seems to be the simplest explanation.

Granting for the moment that reinvention actually took place, the significance of this for general archaeological purposes is far from clear. In the first place, the frequency of independent invention of equivalent traits, through the process of pattern elaboration, is difficult to assay. Problem-oriented research along these lines is necessary. Basic to this is the fundamental question, how common in culture history are elaborating traditions, especially in their substitutive form? Archaeological methods for recognizing and isolating these units need to be refined. Secondly, how great will differences generally prove to be between the original mode and its later approximation, both in the execution of individual specimens and

in the range and frequency of mode forms customarily made at the different times? How much caution in handling modes will be called for; how great is the taxonomic problem of reconciling precision in identifying temporally distinct variations with the range of elaborative play which was going on at a particular time? Third, does pattern elaboration as a causal factor in reinvention even extend beyond the level of the mode, so that there will be difficulty in distinguishing whole vessels, or at least sizable sherds, which were made at different times? It will be noted that this is not the case in any of the examples given in the present paper. Fourth, may some factor other than pattern elaboration prove to be of equivalent or greater significance in the general reinventive process? An obvious instance that comes to mind is the revival of a form of Sikyatki Polychrome by the Hopi potter Nampeyo, who imitated the design on sherds uncovered in archaeological excavations at the nearby ancient village site (Bunzel 1929: 55–7, 80–1). A great deal of earth-moving went on in plaza construction and other architectural work in the Maya area, and this would have increased the opportunity for some male members of the society, at least, to come into frequent contact with earlier, stratigraphically-buried pottery.

To repeat, it has not been fully demonstrated that the erratic distribution of equivalent mode forms within the Maya flange-and-ridge and everted-rim traditions was due to reinvention. Another possibility, which might apply at least to some phenomena of this sort in Mesoamerica, relates to the high degree of community craft specialization, with trade between communities, that is documented ethnographically (Tax 1952: 45–52; McBryde 1947: 54–6, 80) and often inferred for prehistoric times (Brainerd 1958: 20). Local specialization in the manufacture of particular types of pottery might provide a mechanism for perpetuating some specific form of a more generalized tradition. In this case the appearance, disappearance, and reappearance of the form in question at a particular site might be an index to the extent of trading relationships with another community, rather than an indication of the termination and subsequent reinvention of the form. In any case, the role of community specialization in the elaboration of alternative patterns within a broader ceramic tradition is a promising field of investigation in the study of cultural process.

The elaborative and long-sustained treatment accorded flanges and everted rims seems fully to justify their formalization as traditions in Maya pottery. There is a strong suggestion that, following the Preclassic period, they had different histories, the flange-and-ridge tradition flowering in the greater Petén, where rim eversion went into relative eclipse, the latter having a spotty occurrence away from the Maya heartland. The distributional studies have not been made to pin down these conclusions. It is clear, however, that both traditions reflect a general Mayan or Mesoamerican interest in vessel shape as a fit subject for the elaborative process. One might contrast the pottery of the Southwest, where vessel shape was handled conservatively, elaborative play rather being directed toward surface finish and decoration. It would seem to be more than coincidental that the quotations from Pueblo women, given above as indicative of the potter's role in pattern elaboration, relate to painted designs; Bunzel remarks on the Pueblo's matter-of-fact acceptance of vessel shape as lying outside the area of conscious analysis (Bunzel 1929: 49). One might suspect that Mayan potters, manipulating projecting rims and projecting flanges in order to create something slightly new and distinctive, would have been at least almost as articulate about these features as Bunzel's informants were about their designs. Again, however, this is a matter of speculation. In spite of Taylor's impetus (1948) and more recent contributions such as that by Gifford (1960), an adequate set of conceptual tools has yet to be worked out for investigating the embodiment of cultural values in material remains. The necessary hard work—the painstaking tracing of requisite cultural interrelationships—has scarcely begun.

Acknowledgments. Thanks are extended to the following persons for reading a draft of the manuscript and for their helpful criticisms and suggestions: James C. Gifford, Tatiana Proskouriakoff, Carroll L. Riley, Irving Rouse, Robert E. Smith, and Gordon R. Willey. A debt of gratitude is also owed to participants in the Society for American Archaeology's 1955 Seminar in Cultural Stability, whose discussions contributed to certain ideas presented in this paper.

BERLIN, HEINRICH

1956 Late Pottery Horizons of Tabasco, Mexico. *Carnegie Institution of Washington, Publication* 606, pp. 95–153, *Contributions to American Anthropology and History*, No. 59. Washington.

Butler, Mary
1935 Piedras Negras Pottery. *Piedras Negras Preliminary Papers*, No. 4, University Museum, Philadelphia.
1940 A Pottery Sequence from the Alta Verapaz, Guatemala. In *The Maya and Their Neighbors*, edited by C. L. Hay and others, pp. 250–67. Appleton-Century, New York.

Brainerd, G. W.
1958 The Archaeological Ceramics of Yucatan. *University of California, Anthropological Records*, No. 19. Berkeley and Los Angeles.

Bunzel, R. L.
1929 *The Pueblo Potter: A Study in Creative Imagination in Primitive Art*. Columbia University Press, New York.

Dixon, K. A.
1959 Ceramics from Two Preclassic Periods at Chiapa de Corzo, Chiapas, Mexico. *Papers of the New World Archaeological Foundation*, No. 5. Orinda.

Gifford, J. C.
1960 The Type-Variety Method of Ceramic Classification as an Indicator of Cultural Phenomena. *American Antiquity*, Vol. 25, No. 3, pp. 341–7. Salt Lake City.

Kroeber, A. L.
1940 Stimulus Diffusion. *American Anthropologist*, Vol. 42, No. 1, pp. 1–20. Menasha.

Linton, Ralph
1936 *The Study of Man*. Appleton-Century, New York.

McBryde, F. W.
1947 Cultural and Historical Geography of Southwest Guatemala. *Institute of Social Anthropology, Publication* 4. Smithsonian Institution, Washington.

Merwin, R. E. and G. C. Vaillant
1932 The Ruins of Holmul, Guatemala. *Memoirs of the Peabody Museum, Harvard University*, Vol. 3, No. 2. Cambridge.

Newell, H. P. and A. D. Krieger
1949 The George C. Davis Site, Cherokee County, Texas. *Memoirs of the Society for American Archaeology*, No. 5. Menasha.

Phillips, Philip and J. C. Gifford
1959 A Review of the Taxonomic Nomenclature Essential to Ceramic Analysis in Archaeology. MS, Peabody Museum, Harvard University, Cambridge.

Phillips, Philip, J. A. Ford, and J. B. Griffin
1951 Archaeological Survey in the Lower Mississippi Alluvial Valley, 1940–1947. *Papers of the Peabody Museum, Harvard University*, Vol. 25. Cambridge.

Rands, R. L. and B. C. Rands
1957 The Ceramic Position of Palenque, Chiapas. *American Antiquity*, Vol. 23, No. 2, pp. 140–50. Salt Lake City.

Rands, R. L. and C. L. Riley
1958 Diffusion and Discontinuous Distribution. *American Anthropologist*, Vol. 60, No. 2, pp. 274–97. Menasha.

Rouse, Irving
1960 The Classification of Artifacts in Archaeology. *American Antiquity*, Vol. 25, No. 3, pp. 313–23. Salt Lake City.

Rowe, J. H.
1959 Archaeological Dating and Cultural Process. *Southwestern Journal of Anthropology*, Vol. 15, No. 4, pp. 317–24. Albuquerque.

Ruz Lhuillier, Alberto
1955 Exploraciones en Palenque: 1952. *Anales del Instituto Nacional de Antropologia e Historia*, Vol. 6, Part 1, pp. 79–110. Mexico.

Sanders, W. T.
1960 Prehistoric Ceramics and Settlement Patterns in Quintana Roo, Mexico. *Carnegie Institution of Washington, Publication* 606, pp. 155–264, *Contributions to American Anthropology and History*, No. 60. Washington.

Smith, R. E.
1952 Pottery from Chipoc, Alta Verapaz, Guatemala. *Carnegie Institution of Washington, Publication* 596, pp. 215–36, *Contributions to American Anthropology and History*, No. 56. Washington.
1955a Ceramic Sequence at Uaxactun, Guatemala, two volumes. *Middle American Research Institute, Publication* No. 20. Tulane University, New Orleans.
1955b Pottery Vessels from Campeche. *Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*, No. 125. Cambridge.

Tax, Sol (editor)
1952 *Heritage of Conquest*. Free Press, Glencoe.

Taylor, W. W.
1948 A Study of Archeology. *Memoirs of the American Anthropological Association*, No. 69. Menasha.

Thompson, J. E.
1939 Excavations at San Jose, British Honduras. *Carnegie Institution of Washington, Publication* 506. Washington.

Thompson, R. H. (editor)
1956 An Archaeological Approach to the Study of Cultural Stability. In "Seminars in Archaeology: 1955," edited by Robert Wauchope, pp. 31–57. *Memoirs of the Society for American Archaeology*, No. 11. Salt Lake City.

Wauchope, Robert
1950 A Tentative Sequence of Pre-Classic Ceramics in Middle America. *Middle American Research Institute, Publication* No. 15, *Middle American Research Records*, Vol. 1, No. 14, pp. 211–50. Tulane University, New Orleans.

Willey, G. R.
1945 Horizon Styles and Pottery Traditions in Peruvian Archaeology. *American Antiquity*, Vol. 11, No. 1, pp. 49–56. Menasha.

University of Mississippi
University, Miss.
September, 1960

CHANGING PATTERNS OF TERRITORIAL ORGANIZATION IN THE CENTRAL HIGHLANDS OF CHIAPAS, MEXICO

ROBERT M. ADAMS

ABSTRACT

The results of seven months of archaeological reconnaissance in the Tzeltal-Tzotzil-speaking area of Chiapas are described. Occupation is found to have consisted only of a few, small, widely dispersed centers during the Preclassic period. During the latter part of the Early Classic period there is evidence of a considerable increase in population, and by Late Classic times nucleated ceremonial-dwelling centers were widely distributed on steep, easily defended headlands. Despite great variation in the size of individual settlements, it is argued that independent communities rather than regional coalitions were the prevailing form of socio-political organization. This pattern was replaced gradually during the Postclassic period by one in which more intensive use was made of the larger, more strategically located valleys. Closely spaced, functionally interdependent groups of communities emerged, and probably were increasingly subject to new and more coercive patterns of political, as well as religious, control. At the time of the Spanish conquest hostilities and trade with other Mesoamerican groups were increasing rapidly, but the region as a whole still remained relatively tarriant and isolated.

IN CONTRAST with all of the great prehispanic centers of Mesoamerica, Highland Chiapas is a little-known and seemingly unpromising area for archaeological research. Unendowed with stelae or corbelled architecture and characterized by no distinctive art style, it remains today a marginal and backward region haunted by vestiges of the colonial past which elsewhere in Mexico have been swept away. Although lying athwart or alongside of major presumed routes of trade and migration, its own internal sequences of development accordingly received no systematic attention prior to the recent survey and excavations conducted by the New World Archaeological Foundation in the valley of the Grijalva River (Lowe 1959). Moreover, even the N. W. A. F. studies are of limited relevance, having been largely confined to the immediate environs of the river at the bottom of its great trench rather than to the adjacent slopes and highland plateau proper.

Yet it can be argued that for some purposes the relative backwardness of Highland Chiapas is not a deterrent but an inducement to archaeological study. For example, kinds of political and social organization may have survived there to be recorded in the accounts of the early *conquistadores* which in more advanced regions like Central Mexico had been superseded and destroyed already in prehispanic times by newer, more complex institutional forms. More importantly, the persistence in Highland Chiapas of Indian corporate communities that retain their own languages and cultural heritage down to the present day creates an unusual opportunity to base prehistoric synthesis on several parallel and complementary lines of inquiry. The present article represents one facet of such an attempt, which ultimately will seek to combine archaeological results with data from historical linguistics, archival research, and the comparative study of social organization in contemporary Indian communities.

THE ENVIRONMENTAL SETTING

An account of the contemporary habitat and settlement, even if necessarily much condensed, may help to make more intelligible the patterns of prehispanic occupation that emerge from archaeological reconnaissance. The core of the Central Highlands of Chiapas is a massive plateau of Cretaceous limestone. Its gently rolling summit, for the most part between 2000 and 2500 m. in elevation, is extensively scarred with sinks although there is little surface drainage. Fault-line scarps have divided the area into ridges and basins draining internally, the largest of these enclosed, relatively shallow valleys being occupied by the city of San Cristóbal de Las Casas.

Except in some of the larger basins contemporary human settlement is closely tied to the infrequent water holes that can be relied upon throughout the dry season. Thus the indigenous Tzeltal and Tzotzil community that prevails through most of the area is the house cluster or larger *paraje* grouped around one or more water holes while maintaining important social and ceremonial ties with a "vacant town" center like Zinacantán or Chamula (Vogt 1959). Maize is grown in forest clearings at all altitudes on the plateau summit, but subsistence there now depends to a greater degree on sheep raising, wage labor, and the produce of rented or communally-owned *milpa* lands at much lower altitudes. By contrast, the prehispanic

distribution of settlements in the main is confined to the interior basins and their immediately surrounding hills, suggesting that cultivation of bottom lands in these basins was a far more important source of local subsistence than it is at present.

Below the plateau rim the prevailing physiographic pattern is one of terraced slopes, with steep descents between small plains arranged in ascending steps. Surface drainage becomes more important with decreasing altitude, and deep valleys have been carved into the skirts of the plateau on all sides. Springs are increasingly numerous at lower elevations, providing plentiful water for coffee, fruits and sugar cane; these and similar crops become important below an altitude of perhaps 1500 m. Simultaneously, the dispersed Indian settlements that predominate on the plateau gradually give way to predominantly *ladino* hamlets and towns that are interspersed with large *fincas* and cattle ranches, while the stands of pine and oak of the higher elevations are replaced first by oak and then by tropical broadleaf forest and savannah. Although nowhere as densely distributed or varied in type as modern communities, prehispanic sites also are found at all altitudes along the plateau slope. Fairly steep slopes will sustain *milpa* agriculture, but both present and prehistoric settlements tend to cluster instead in or around the principal valleys and open plains.

The Reconnaissance and Sequence

This account is based on the results of two seasons of archaeological survey. During the first, from September 1958 through January 1959, attention was directed primarily to the eastern half of the area shown in Figure 1, where an attempt was made to visit and record all archaeological sites on which information had been obtained with the aid of a number of collaborating social anthropologists and geographers who then were working in the area. Simultaneously, a small-scale program of stratigraphic testing was carried out at a few of the more promising sites, primarily under the supervision of T. P. Culbert. The second season, during February and March 1960, was devoted to an extension of the surface reconnaissance further to the north and west, but on a less complete and systematic basis. In addition an attempt was made to supplement earlier stratigraphic results through further excavations.

A provisional chronology for the Central Highlands of Chiapas is given in Table 1. Although representing a substantially continuous sequence, the five local phases thus far identified are designated by names rather than numbers in order to allow for possible gaps. The sequence as a whole remains insecurely tied to better established stratigraphic sequences in other regions, and some or all of its phases probably are subject to a considerable time-lag relative to the major Mesoamerican centers. Like the reconstruction of sequent patterns of settlement which follow, the details of the sequence remain subject to modification as a result of further work that is planned.

Table 1. Highland Chiapas Sequence

Local Phase	*Suggested Equivalent Mesoamerican Period*
Conquest	Conquest
Lum	Late Postclassic
Yash	Early Postclassic
Tsah	Late Classic
Kan	Early Classic
Sak	Late Preclassic

Early Phases of Occupation

Relative to the important Preclassic developments not only in the Guatemala Highlands but even in the nearby valley of the Grijalva River, the central plateau of Chiapas was slow to emerge as a cultural center. Surveys to date have disclosed only one Sak phase (Late Preclassic) open site (Fig. 2) and one which may be transitional to a later period (Fig. 3 *a*). Both are very modest valley-bottom or terrace-margin settlements, consisting of a scattering of house platforms around a central pyramid 6 to 8 m. or more high; a few other, much smaller, ceremonial mounds or platforms also may have been present.

It is possible, to be sure, that Preclassic sites have been destroyed more frequently than later ones. Since they are generally located on valley floors, they are perhaps disproportionately affected by tillage practices and the deposition of soil from eroding valley sides. But while some very small settlements may have been obliterated in this fashion, soil redeposition does not appear to have been extensive anywhere in the region, and the prevailing digging-stick or hoe cultivation has little effect on mounds. Moreover, the valley bottoms gen-

FIG. 1. Map of the area of archaeological reconnaissance in the central Chiapas Highlands.

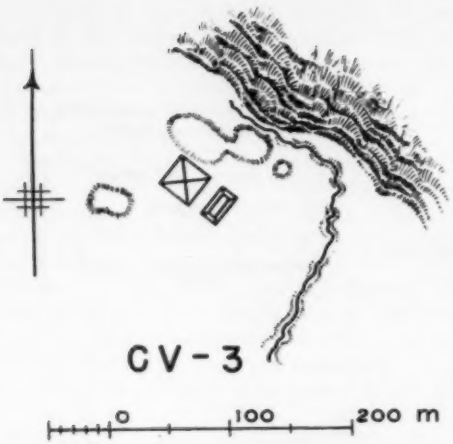

Fig. 2. Late Preclassic valley-bottom site (CV-3).

erally are in open fields or pasture, permitting even very small structures easily to be seen. Hence it seems reasonable to conclude that the relative paucity of Preclassic remains both on the terraced margins of the plateau and on its summit is not an artifact of the reconnaissance but an objective datum, the more so since all of the factors mentioned should apply equally to other regions where Preclassic ruins are extensive and well-known. If so, this finding underlines the striking discontinuities that apparently were possible in population density and level of development between regions as close to one another as the Grijalva trench and the adjacent central plateau. It also suggests that the primary cultural influences reaching the plateau probably stemmed from the numerous Preclassic centers along the Grijalva River (Lowe 1959: 10–14).

Classic Headland Settlements

While cross-ties exist with the later part of the ceramic sequence at Chiapa de Corzo in the Grijalva River valley, the beginnings of widespread occupation of the uplands differ substantially from any phase of that sequence and cannot be regarded as an outgrowth of it. In particular, the dominance of an Early Classic black-ware complex along the Grijalva (Lowe 1959: 15) finds no parallel on the plateau. What ensued was an apparently rapid increase in at least the number (if not necessarily the size) of upland settlements, coupled with the introduction of numerous new ceramic wares and forms. This could have been a consequence of purely local increases of population, but the attenuation of cross-ties with the Grijalva suggests that cultural stimuli from another direction, possibly accompanied by a population influx, may have played a part.

This conclusion is supported by glottochronological data assembled by N. A. McQuown (1959). The Maya highlands of central Chiapas are occupied today, as they were at the time of the Spanish conquest, by Tzeltal and Tzotzil speakers. The extremes of separation between these groups are estimated at 1000 to 1500 years. Chuj, their nearest relative, is separated from them by 16 or 17 centuries, while Tojolabal lies at a linguistic distance of 20 to 22 centuries. From this it appears that the closest affiliates of the occupants of the central plateau are to be found to the southeast, perhaps centering along the slopes of the Cuchumatanes, and that the Tzeltal and Tzotzil probably differentiated locally in their present homeland after entering the region from that direction during the Classic period.

The time of the apparent influx into the Chiapas highlands remains somewhat uncertain. Probably it coincided with the latter part of the Early Classic and may have continued somewhat later still, a period which witnessed the first appearance of sculptured monuments in the region southeast of Comitán (a ball-court marker at Chinculticc) in A.D. 591 (G. M. T. correlation, Morley 1938: 368). Since the practice of erecting stelae continued in the Comitán valley until A.D. 879 at the site of Quen Santo (Morley 1938: 371), and since there is little evidence of ceramic, architectural or sculptural contacts between that area and the central Chiapas plateau, it seems unlikely that the antecedent group out of which the Tzeltals and Tzotzils differentiated moved directly through the Comitán valley. Instead it might be posited that they moved well to the north of Comitán, perhaps entering the highlands from the Ocosingo region. But it should be stressed that speculations on the source and character of this apparent migration will remain premature until more is known of the early phases of occupation not only in the Comitán valley but in the Lacandón jungle to the east.

Beyond the occurrence of sparse Kan phase ceramics at many headland sites which continued to be occupied into later periods, the char-

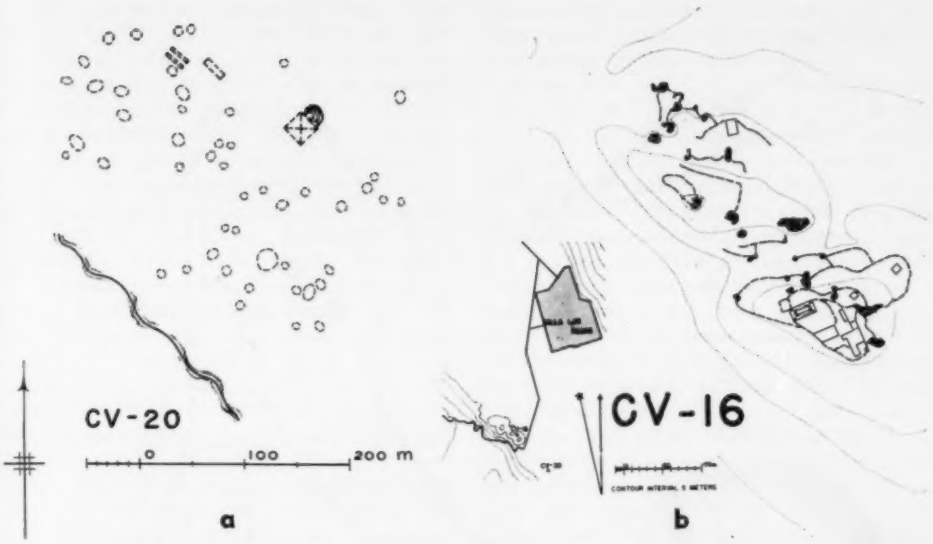

FIG. 3. Late Preclassic and Early Classic plateau-rim sites. *a*, Late Preclassic (CV–20); *b*, Early Classic (CV–16), inset at lower left shows relation of CV–16 and CV–20 to Villa Las Rosas.

acter of this earliest widespread occupation is still poorly understood. Only at one site (Fig. 3 *b*) can the known architecture be assigned with certainty to this phase; here it consists of a small, rather dispersed settlement built on low, irregularly terraced hills along the rim of one of the great echeloned steps descending from the plateau summit. In plan, this site is typical of the succeeding phase as well; what distinguishes it is only its placement along a series of gently sloping hills which offer little advantage for defensive purposes. We cannot be sure, of course, that the selection of potentially defensible positions in most of the remaining cases implies that warfare was becoming important in the area even before the end of the Early Classic period. Vogt (1959) recently has emphasized the importance of sacred mountains in contemporary Tzeltal-Tzotzil ceremonialism, implying at least one alternative basis for the selection of headland sites. But at the same time, the shift to defensible hilltop locations later became demonstrably associated with military considerations, so that it might have been in this early period as well.

In the trench of the Grijalva River, the shift away from valley-bottom sites seems to have taken place only during the transition from Early to Late Classic times. Although the Late Classic features of the Grijalva occupation are not yet well known, the shift in location was accompanied by discontinuities in architecture and ceramics (Lowe 1959: 15). This may indicate that the abundant remains of that period present there were a product of new groups who arrived during the later part of the same population disturbance which brought the Tzeltals and Tzotzils into the Highlands. In spite of Chiapanec expansion in the valley in Postclassic times, it is noteworthy that the Spaniards encountered Tzotzil speakers as the dominant ethnic group along the foot of the plateau north of the Grijalva as far west as Totolapa and Zapotal (Flores 1955: 35–6).

The succeeding Tsah phase is much more adequately documented. Spanning most of the Late Classic period, it may have continued into Postclassic times for as much as several centuries. However, in the general absence of trade wares on the plateau, or of securely dated stratigraphic (or even typological) sequences for this later time range from excavations in the Grijalva valley (Lowe 1959: 18), the terminal date of the phase must remain elastic and relative rather than absolute.

At least on present evidence, the most widespread occupation of the region was achieved at this time. Settlements were regularly placed

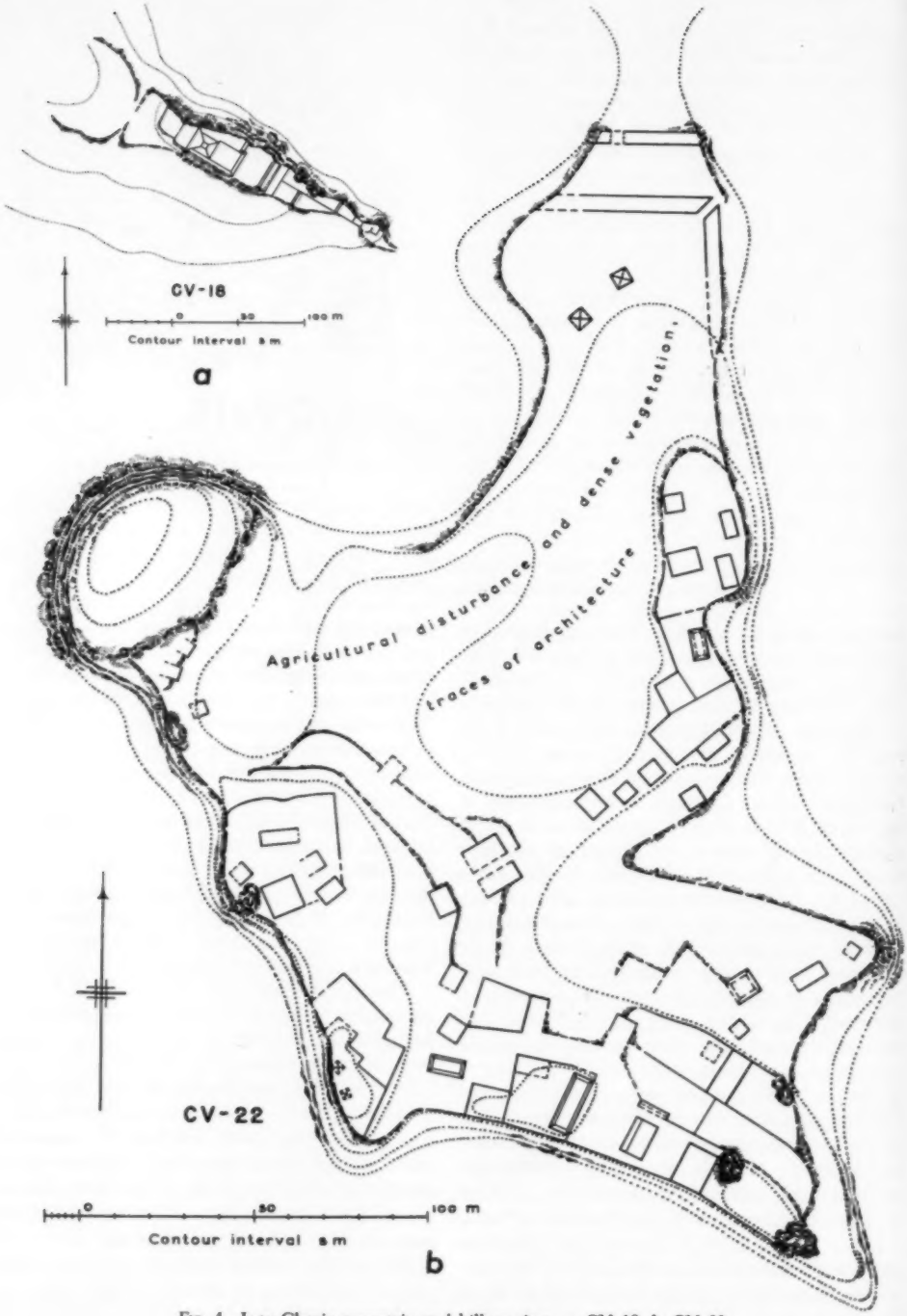

Fig. 4. Late Classic mountain and hilltop sites. *a*, CV–18; *b*, CV–22.

in highly defensible locations on steep ridgelines, bluffs, hilltops, or even sharp andesitic pinnacles, and although traces of artificial defensive features to supplement the advantages of location are seldom found at present, they originally may have been common. The disappearance of perishable palisades, for example, is easily understandable, while more durable defenses placed at the brinks of steep slopes were especially subject to destruction from undercutting and surface erosion. Moreover, the echelons of terraces composing the living areas of most of the sites frequently must have been formidable as defensive works. Although for the most part poorly preserved, in places they still stand to heights of 3 to 4 m. Undeniable evidence that permanent military installations at times were constructed is provided by Cerro Chavín (Fig. 4 *b*). This small settlement stood on a bluff-like promontory which drops away in sheer cliffs on all sides except where it is connected to the main mountain massif by a narrow isthmus. As the plan shows, its inhabitants sought to close this single avenue of potential attack by erecting across it two parallel stone walls with offset entrances. In short, it seems certain that military considerations played a part in the placement of settlements, and that at least in some cases the natural defensive advantages of terrain were supplemented with artificial measures.

As has already been indicated, the date for the beginning of this practice is still uncertain. The possibility must be recognized that in other respects Central Chiapas lagged considerably behind more developed areas like the Maya lowlands (Lowe 1959: 15), but at least on present evidence the onset of militarism here seems roughly contemporary with — and may even precede — the first substantial evidence in representational art for warfare in the Usumacinta basin and in southeastern Campeche (Armillas 1951: 78). Moreover, similar defensive works in Highland Guatemala were several centuries later in making their appearance. Although potentially defensive sites also became important there during the Late Classic period, artificial constructions for defensive purposes only were introduced as a result of Mexican influences in protohistoric times (Smith 1955: 72). In short, although this was a relatively marginal and "underdeveloped" region the introduction of warfare in the Chiapas Highlands appears not to have been an isolated or delayed phenomenon but fully to have kept pace with wider trends toward militarization which had repercussions throughout Mesoamerica.

Several features of the distribution of the Late Classic and early Postclassic sites deserve attention. Their location, apparently without exception, on commanding headlands has already been pointed out, but a further patterning is evident in the location of the hills and ridges that were selected for occupation. There is a marked clustering of these hills around flat-bottomed valley areas suitable for intensive agriculture, with preference apparently being given not to the largest basins or valleys but rather to those of moderate size. Thus, around the small internally drained basin occupied today by the towns of Teopisca and Amatenango there are three sites which can be assigned to this phase on the basis of ceramic surface collections (Fig. 5 *a*, CV–5, CV–7) and three others (Fig. 6 *a*, CV–11, CV–13) probably of the same period although surface collections were inadequate to establish their date. Again, around the still smaller Aguacatenango valley one finds two definitely contemporary sites (Fig. 5 *b*, CV–29) and two others that are probable (CV–19 in Fig. 5 *b*, Fig. 6 *b*). By contrast, the hills around the much larger valley containing the city of San Cristóbal seem to have been occupied by no more than three sites at this time (Moxviquil, perhaps Fig. 7, CV–31).

While there is danger of overgeneralizing from inadequate data, this picture seems to consist for the most part of fairly isolated pockets of intensive settlement; the pockets in most cases corresponding to what is today the most desirable and densely occupied bottom land. In some instances, as with Yerba Buena (Fig. 8) and the nearby valley now occupied by the town of Cruz Quemada, a single large site seems to have served an entire small basin. More commonly, as around the Teopisca valley, a number of small contemporary settlements apparently were present. But in any case, each settlement, regardless of size, apparently needed to maintain its own defensive position. Coupled with the absence of observed architectural or other differences suggesting patterns of functional specialization that involved several sites, this suggests that independent communities rather than regionally organized groups of communities were the dominant form of socio-political organization for the area and period.

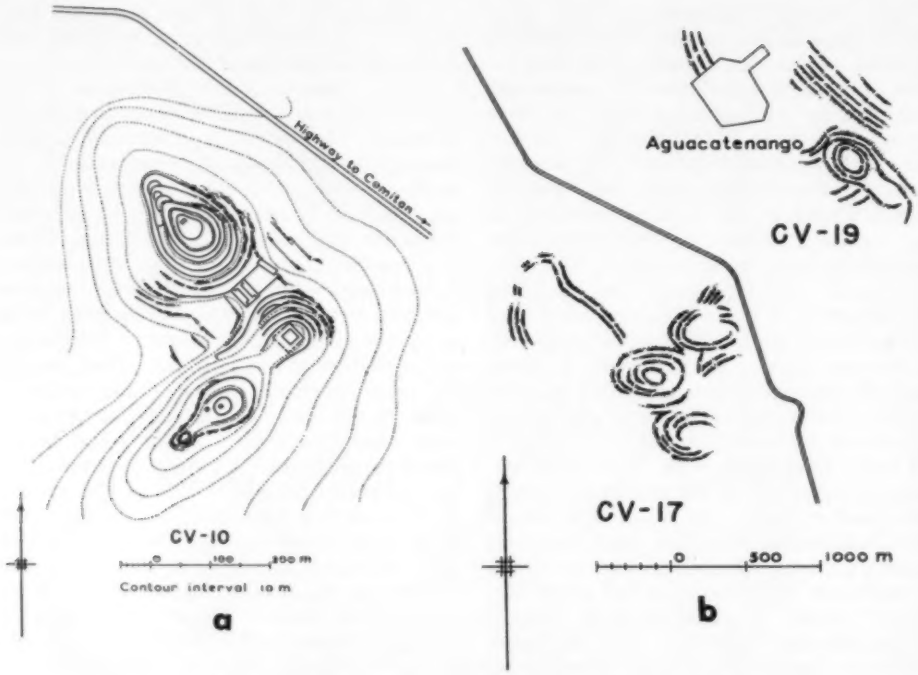

Fig. 5. Late Classic mountain and hilltop sites. *a*, CV–10; *b*, CV–17.

It is not clear, of course, whether these communities were mutually hostile, or whether instead their political fragmentation was a consequence of external (for example, Pipil or Chiapanec) pressure. But whether or not external pressure was a factor, there is no evidence in ceramics of a significant penetration of the region by groups involved in inter-regional trading relationships. The rarity of Fine Orange and Plumbate pottery instead suggests that, as compared with the Guatemala Highlands or even the nearby valley of the Grijalva River, the central Chiapas plateau remained an isolated and backward region not directly influenced by any of the major Mesoamerican centers.

This impression is strengthened by a consideration of the architectural components of the sites themselves. In contrast with earlier and contemporary centers in many other parts of Mesoamerica, the Chiapas Highlands settlements of Late Classic and early Postclassic date are characterized by a relative lack of attention to ceremonial structures. With the exception of single ball courts at some of the larger sites, small altar-platforms or possible substructures for perishable shrines represent almost the only type of ceremonial construction found. As compared with other parts of the Maya area at that period the volume of ceremonial building is small in relation to the apparent size of population. In addition, careful craftsmanship, for example, in stone sculpture and veneer masonry, is distinguished by its absence. Moreover, no remains of masonry structures, as distinguished from supporting platforms, were noted during the survey. Accordingly, it is assumed that temples and houses alike were of simple wattle-and-daub or pole-and-thatch construction. Finally, the complex of architectural traits suggesting Mexican influence which is widely distributed in Highland Guatemala (Smith 1955: 75–7) does not occur in the central Highlands of Chiapas. Aside from the aforementioned introduction of fortifications there is only one respect in which this relatively marginal and tarriant area during Late Classic and early Postclassic times apparently was abreast or ahead of contemporary architectural trends elsewhere: fully en-

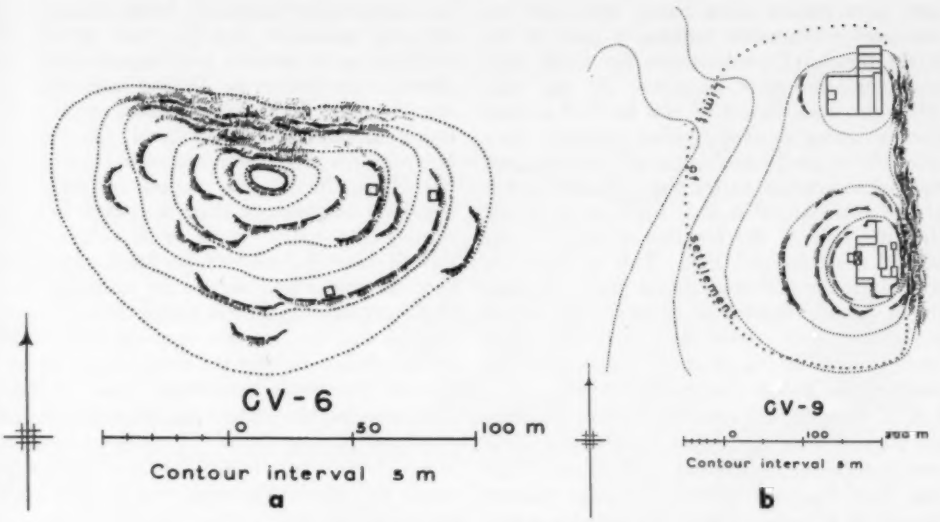

FIG. 6. Undated sites. *a*, CV–6; *b*, CV–9.

closed ball courts (Figs. 5 *a*, 8, 10) have been thought to appear in Highland Guatemala only in the subsequent protohistoric period (Smith 1955: 71).

The most common basic conception of a settlement during this phase seems to have called for a symmetrical arrangement of descending terraces of crude masonry crowning a hilltop in the form of a truncated cone. A number of the larger communities needed greater surface areas than could be obtained on a single hill and so were gradually extended to cover two or more adjoining summits (Figs. 4 *a*, 5, 8; CV–5, CV–12, Moxviquil). In fact, at Yerba Buena (Fig. 8) which approaches urban proportions in both occupied area and apparent density of settlement, debris and terraces are found along an enclosing ring of five ridgelines and hills. But a central concentration around one hill always is evident, and the ruins on outlying summits seem to reflect a diminishing density and perhaps duration rather than separate nucleated communities. To be sure, there may have been some independence in ceremonial practices, since at two sites (Figs. 5 *a*, 8) small mounds were placed on the crests of outlying terraced hills.

At the smaller sites the summit terraces generally were devoid of platforms or other artificial structures, but they included outcrops of native rock which may have served as altars. The summit terraces of the larger sites (Figs. 5 *a*, 8, Moxviquil) were surmounted by small pyramids or platforms, and additional ceremonial structures, including the ball courts, were placed on lower slopes or in saddles between adjoining summits. With the exception of Yerba Buena and perhaps Cerro Mispía (Fig. 9) none of the sites are large, and most can properly be described only as villages.

In addition to the densely grouped house terraces forming the major loci of settlement, some indications were found of more dispersed patterns like those which are common today on the plateau summit. For example, there is a single illustration of a presumably independent center with its own ceremonial buildings, which was very loosely strung out for several kilometers along a ridgeline (Fig. 10). A more common variant was suggested by thin scatterings of debris at intervals along low terraces that followed the intersection of interior basins or level shelves with slopes leading up to headland settlements (CV–5, CV–17, CV–19, CV–22, CV–23, Moxviquil). From the absence of debris for considerable distances along such terraces, it seems reasonable to conclude that their primary function was agricultural: they assist in erosion control, and they serve to impound runoff from the valley slopes above. However, since sherds do occur at intervals it is also possible that scattered hamlets or house

sites were placed along them, with their inhabitants presumably forming a part of the larger headland communities for social, religious, and defensive purposes. At any rate, while the areal extent of this kind of agricultural terracing along the valley margins is considerable in some cases (especially that around the Aguacatenango valley, Fig. 5 *b*), the density of occupational refuse is so slight as to suggest that the bulk of the population generally occupied the headland sites. This is especially true since the scattered debris might not represent former residences in situ, but instead might have been carried out to agricultural terraces as fertilizer, a practice still followed in some of the Indian communities today.

E. Z. Vogt (1959) recently has argued, citing the parallel between Classic Petén data and his own findings at Zinacantán in Highland Chiapas, that the basic Maya settlement pattern consists of a "vacant town" type of ceremonial center surrounded by dispersed hamlets. He sees the priestly hierarchies being filled not by full-time specialists, but by yearly systems of rotation, as at present, and suggests that nucleated communities are the products either of special geographical circumstances or of Central Mexican or Spanish conquest. On balance, however, the greater importance in the Chiapas Highlands during this period of nucleated headland settlements than dispersed hamlets skirting the valley floors seems clear, even though direct influences from Mexico have not been identified and seem very unlikely. Part of the explanation for this apparent discrepancy may be that the sparsely supplied water holes of the plateau summit require a greater dispersion of Zinacantán settlements than of those communities that occupy the larger basins and the lower plateau slopes. To a degree, in other words, Vogt's parallelism may not fairly represent the natural variation along a nucleated-dispersed axis that is characteristic of the contemporary Chiapas scene. But perhaps in part

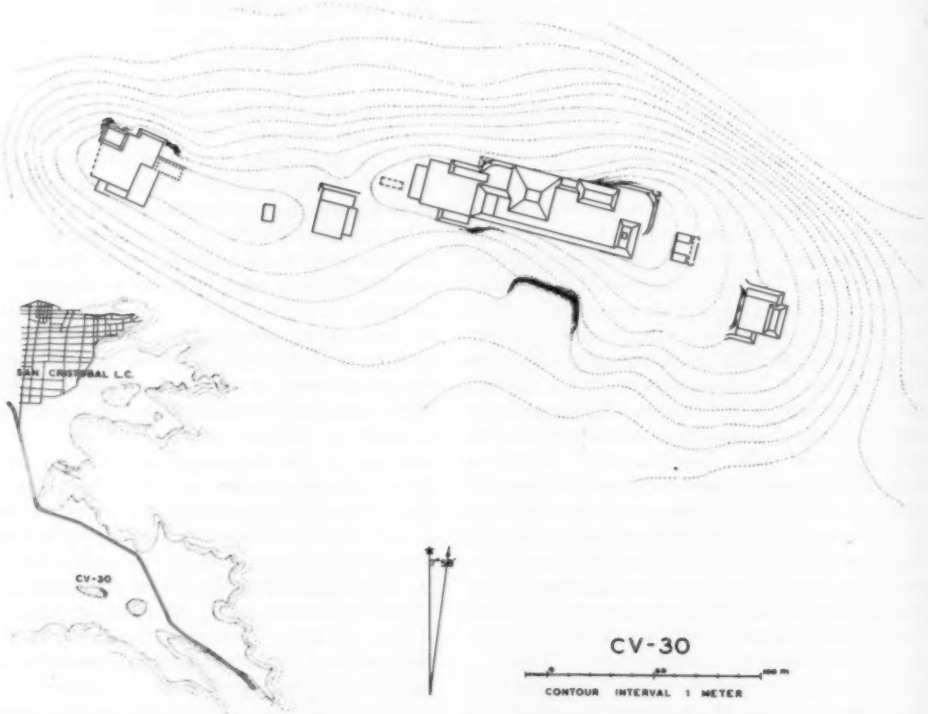

Fig. 7. Late Classic or Early Postclassic site (CV–30). Inset at lower left shows relationship of site to San Cristóbal de Las Casas.

FIG. 8. Yerba Buena, a large Late Classic hilltop center (CV-14). Plan of site to the right and details of Ceremonial Groups A and B to left.

also, we need only to substitute the vaguer term, growth of militarism, for the more specific hypothesis of a Mexican invasion. Whatever the basic Maya settlement pattern may have been, there would have been heavy pressure to shift toward more nucleated settlements as hostilities became increasingly common during the latter part of the Classic period.

Postclassic Regional Groupings

With few exceptions, the independent, defensively organized centers that were grouped around scattered, favorable valley bottoms during the Late Classic period ceased to be occupied during the centuries immediately following. At the time of the conquest the Spaniards encountered instead a smaller number of more complex and powerful political groupings that were concentrated in and around the larger, more strategic valleys like that of San Cristóbal de Las Casas on the plateau summit, or of the Río San Vicente at the foot of the slope into the Grijalva trench. Lesser basins, on the other hand, like those of Teopisca, Amatenango, and Aguacatenango apparently were unoccupied by any substantial permanent settlement.

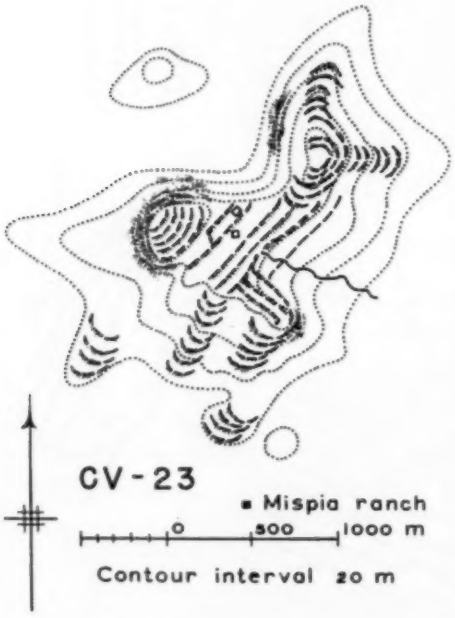

Fig. 9. Cerro Mispia, a Late Classic mountain site (CV–23).

The transition between these patterns apparently occurred during the Yash phase of the Chiapas Highlands sequence, which must have spanned the early and middle Postclassic periods. Most of the widely distributed headland sites were abandoned before or at the end of the preceding phase, but there is evidence that particularly the larger centers (Figs. 8, 9, 11) persisted somewhat longer. Moreover, two important new centers came to prominence during this phase, although apparently neither outlasted it. One of the new sites (CV–42) differs little in appearance or situation from its predecessors, although larger than most of them. The other, Na Balam or San Gregorio (Fig. 12), perhaps represents the beginning of an attempt to establish wider territorial control. Its large size and commanding position suggest that it dominated the broad, fertile valley of the Río Tzaconeja for a considerable distance; the sharp separation between its secular and ceremonial precincts is an important new feature not noted in an earlier description (Schumann 1936).

The best known example to date of the final prehispanic (Lum phase) pattern of settlement is Copanaguastla (Fig. 13), where historically attested early colonial irrigation may have begun already in aboriginal times. Although only one of its component prehispanic communities has yet been mapped, two others nearby that are comparable in size and arrangement have been briefly visited and stratigraphically tested. There are additional sites (Fig. 14) as well as unverified reports of others lying in both directions along the south bank of the Río San Vicente. No defensive arrangements have been identified for this group of closely related centers which occupies an open terrain of low hills and rolling bottom land, although all of the Spanish sources combine to make clear that the final preconquest period was one of frequent hostilities. Perhaps an as yet unrecognized citadel on one of the hills served all of the communities. Alternatively, it is possible that the primary burdens of defense had been shifted from natural or artificial barriers to the mobilization of greater manpower and perhaps to newly elaborated techniques of organizing them for military purposes.

In addition to Copanaguastla, several other such groups of related centers or complexes of

FIG. 10. Late Classic or Early Postclassic site (CV-1).

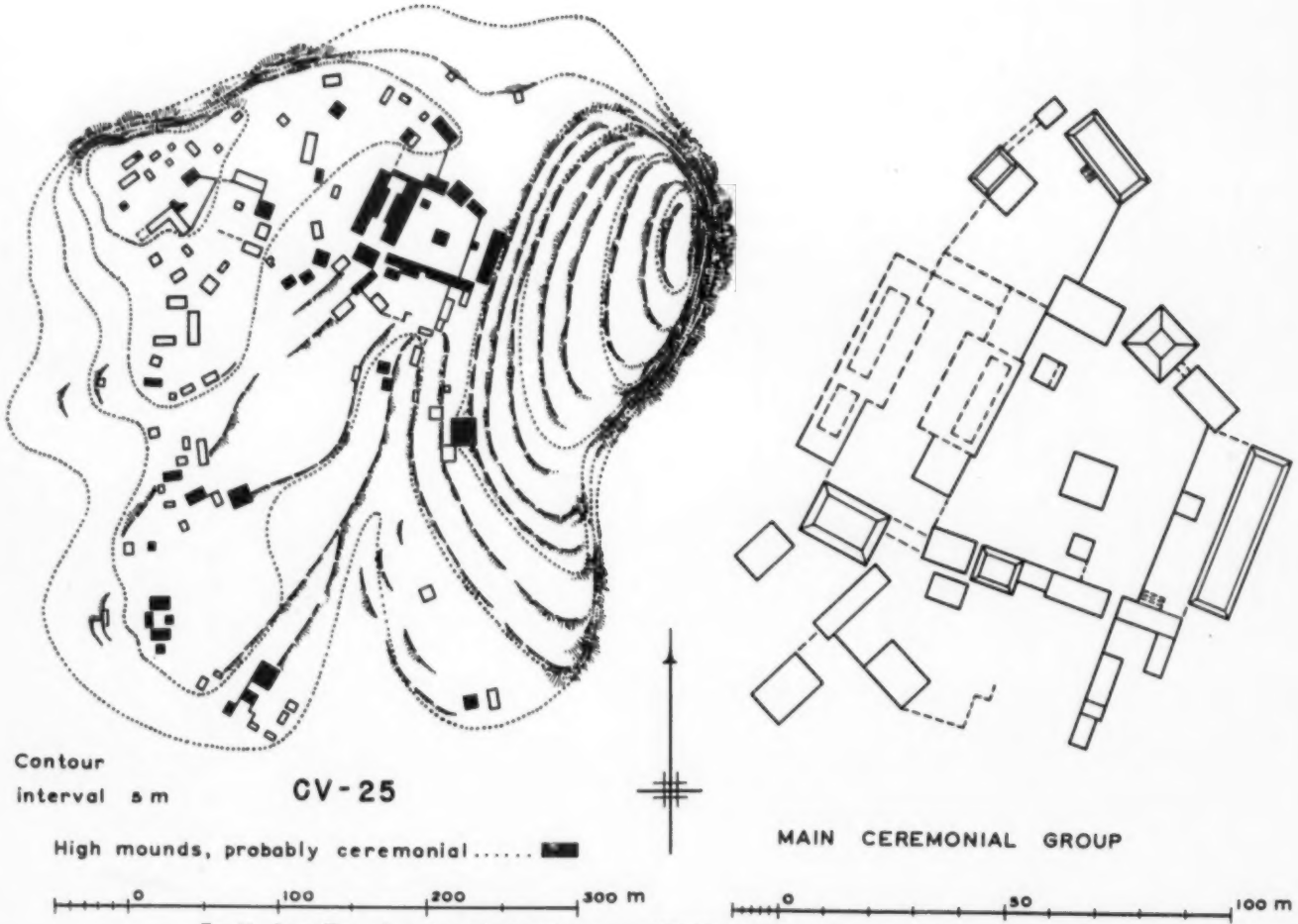

FIG. 11. Santo Ton, a large Late Classic hilltop center (CV–25). Detail of main ceremonial group to the right.

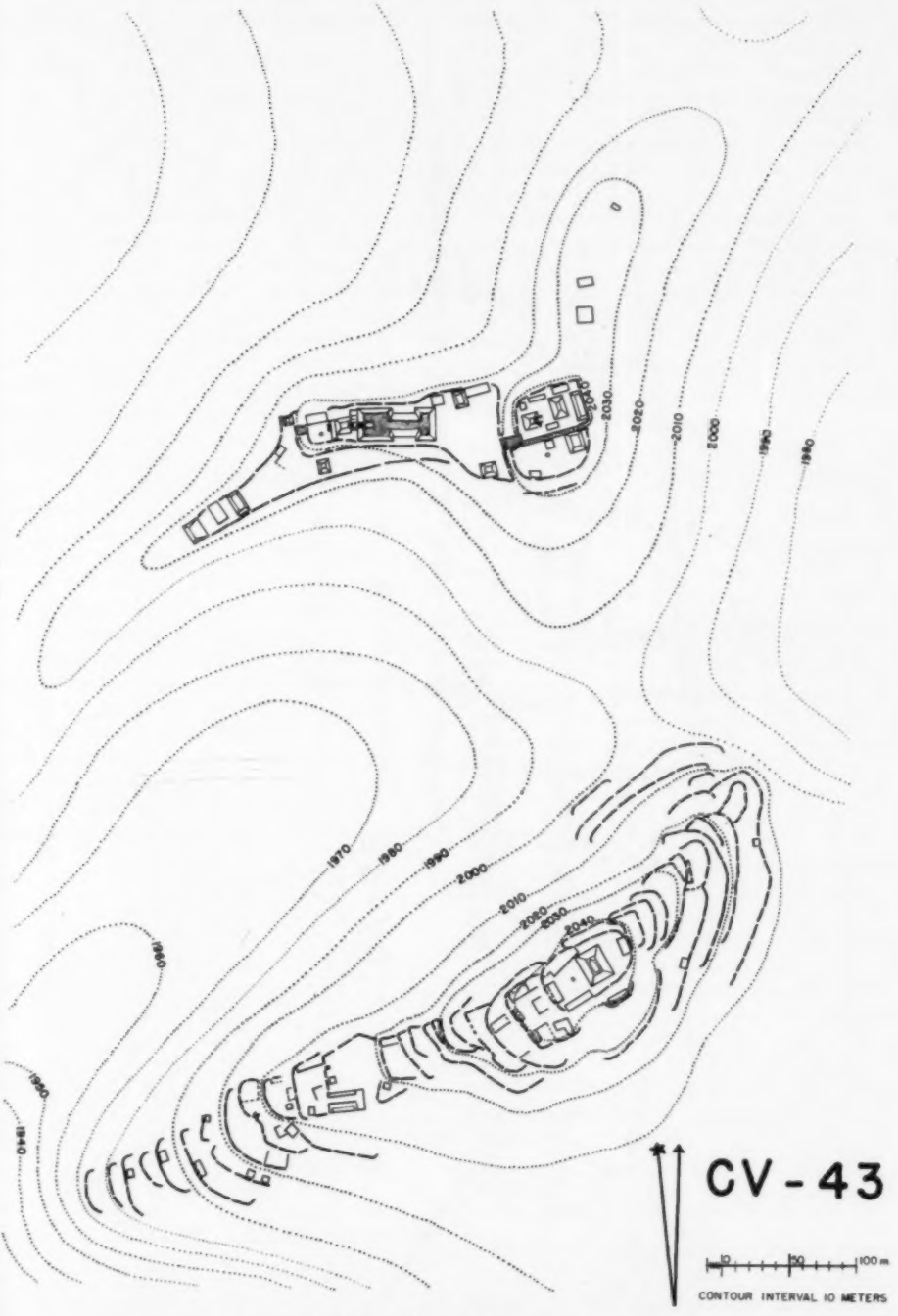

FIG. 12. Na Balam, a large Early Postclassic site (CV–43).

FIG. 11. Santo Ton, a large Late Classic hilltop center (CV–25). Detail of main ceremonial group to the right.

FIG. 13. Copanaguastla (CV–32). Part of the Late Postclassic political center to the left of the subsequent Early Colonial town.

centers and their dependencies can be provisionally identified. Zinacantán was situated on the plateau summit, probably not far from its present location in a well-watered valley west of San Cristóbal de Las Casas, and Spanish accounts speak not only of the central town but of subsidiary villages in the area around it (Godoy 1858: 465). While a surface reconnaissance of the environs of Zinacantán has not been possible, one of its outlying forts or ceremonial enclaves may have been placed on the nearby peak of the extinct volcano, Huitepec (CV–37). Three leagues away lay Chamula, whose capture after a pitched battle with "over a thousand lancers" (Díaz 1912: 306) fortunately has come down to us in two separate descriptions; it controlled or dominated a number of nearby villages from which the population withdrew into the citadel upon the arrival of the Spaniards (Godoy 1858: 465). Tentatively accepting Frans Blom's proposed identification of it with Cerro de Ecatepec (CV–31), it would have overlooked the valley of San Cristóbal de Las Casas from an imposing fortified summit to the south. Adjoining smaller villages were strung out along a flanking ridge, and a possibly contemporary ceremonial center (Fig. 15 *b*) was placed directly below, at the junction of the mountain slope with the valley floor. Probably a part of the same complex was La Hermita or Cerro Santa Cruz (Fig. 15 *a*), with its cruder ceramic wares and restricted repertoire of forms suggesting a dependent and impoverished role for the site's occupants. Still another subsidiary village occupied a knoll on the valley bottom (CV–44), and isolated contemporary ceremonial structures are found at points where major trails debouch into the valley from surrounding hills.

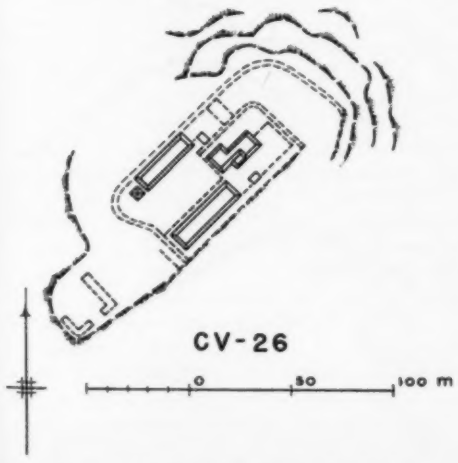

FIG. 14. A Late Postclassic site (CV–26).

Across the plateau toward the northwest lay Gueyguistlan, apparently on the site now occupied by the "vacant town" of Santiago (CV–39). Three small adjacent prehispanic settlements were distinguished there during the reconnaissance, perhaps corresponding to the "three villages all standing within forts" that one account describes (Díaz 1912: 309). But elsewhere both a wider territorial extent and a frailer political integration are implied for the "provincia" of Gueyguistlán or Huistlán (Godoy 1858: 467):

> Parécense desde esta cabecera de Huegueyztean diez ó doce pueblos al derredor de ella, todos en la sierra, y le son sujetos. . . . Todos los pueblos de esta tierra son de esta manera, que tienen guerra unos con otros.

Except for the open location of Copanaguastla and perhaps Zinacantán, there is little to distinguish the settlement plans of these late Postclassic centers from their predecessors. What distinguishes between late Postclassic and earlier times is primarily the shift toward the larger valleys which could sustain more intensive patterns of exploitation, and toward the formation of organized groups of communities, each centered on a "capital." In effect, a redistribution rather than a reduction of population seems to have taken place within the region as a whole. It led, in short, in the direction of predatory, territorially integrated, perhaps more "state-like" systems of settlement (although clearly there were as yet no "states" in Highland Chiapas when this trend was truncated by the Spanish conquest) out of generally smaller, more widely scattered and diffusely organized, sporadically warring communities. In the case of the politically more developed Chiapanecs who were hostile neighbors to the south and west, Bernal Díaz (1912: 293) has described the further working-out of a similar process:

> They had even brought other pueblos by force and made them settle and remain near to Chiapas, and held them as slaves and made them cultivate their fields.

During the final centuries before the conquest, as for earlier periods, there is little evidence of Mexican influence in ceramics or architecture. As in earlier periods, moreover,

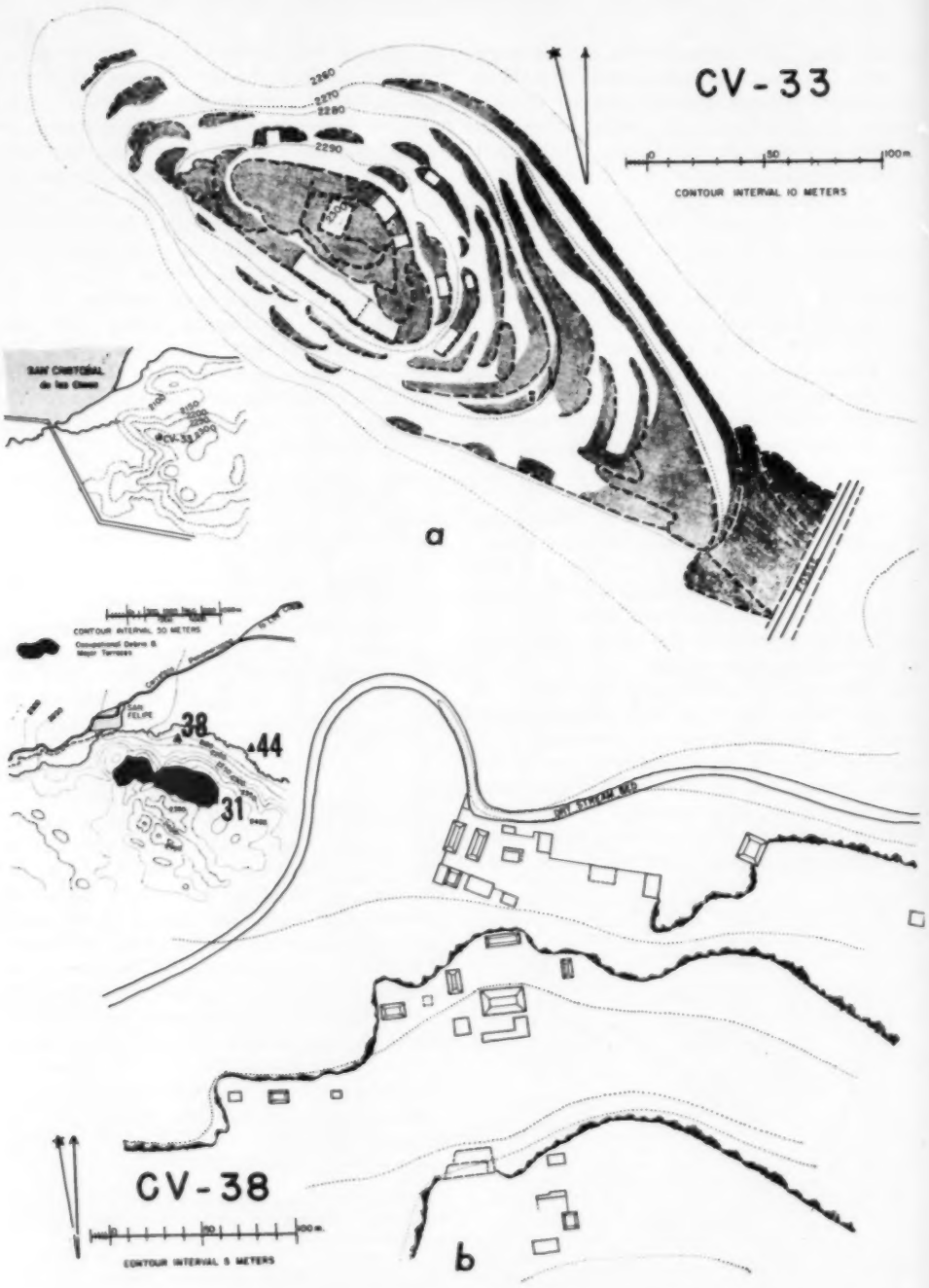

FIG. 15. Late Postclassic sites near San Cristóbal de Las Casas. *a*, La Hermita (CV–33), inset at lower left shows relation to San Cristóbal; *b*, Cerro de Ecatepec (CV–38), inset at upper left shows relation to CV–31, CV–44, and present-day San Felipe.

the area as a whole seems to have remained marginal to the nexus of interregional communication and trade. To be sure, according to Sahagún, amber, quetzal feathers, and skins from the hinterlands of Zinacantán did reach the Aztec capital (Anderson and Dibble 1959: 21–3), and elsewhere the Zinacantecans were described as "sensible people and many of them traders" (Díaz 1912: 305). But Sahagún's account centers upon the mortal dangers to the Aztec merchants who pursued this trade and stresses the careful disguises that were necessary in order to penetrate Zinacantán territory — suggesting that the horizons of such trade were geographically restricted until a very late period.

Major Aztec campaigns against the Chiapanecs in the Grijalva lowlands, and even in Guatemala far to the south, were followed in the Chiapas Highlands only by an apparently temporary conquest of Comitán (Kelly and Palerm 1952: 307), by the establishment for a short time of a garrison at Zinacantán (Herrera 1945, Vol. 6: 123; Remesal 1932, Vol. 1: 378), and by a more problematical raid on Huistlán or Santiago (Feliciano 1945: 67; Kelly and Palerm 1952: 305 offer another identification of this town). Products and towns of the area are notable for their omission from the Aztec tribute lists. In light of their other accomplishments, the inference is not that the Aztecs avoided the area out of respect for the strength of its defenses. Instead, they seem to have by-passed it in pursuit of more populous and prosperous objectives.

For purposes of the present account, the Spanish conquest may be regarded as terminating our sequence. In fact, as was implied earlier, the interdisciplinary approach of which this is a facet tends to emphasize those threads of historical continuity connecting the prehispanic past with the contemporary scene. But the planned investigations of the impact of the conquest in the central Chiapas Highlands, calling upon data from archaeology, historical archives, and linguistics, are still in their preliminary stages and cannot be reported upon here. An important locus for the further investigation of this problem is Copanaguastla, where a colonial town that replaced an aboriginal political center of the same name was largely abandoned early in the 17th century (Olvera 1951, 1957). It is noteworthy that after the conquest the center of the town was shifted from its earlier position, and that a grid pattern was introducted (Fig. 13) which had no prehispanic counterpart. Similarly, test excavations in the modern towns of Teopisca and Amatenango have indicated that they began only with the colonial period, underlining the considerable discontinuity that apparently exists between prehispanic and colonial patterns of settlement. But while the Spaniards founded new towns and introduced new types of settlement, in at least one respect they merely continued a trend already in progress. The shift in late Postclassic times away from inaccessible headlands and toward more concentrated settlement around the larger valleys was more or less consciously followed by the Spaniards in their *reducción* policy.

Acknowledgments. The substantive ceramic sequence from the excavations currently is under study by T. P. Culbert. Since the surface collections used to date the great majority of sites in the main were themselves dated by comparison with ceramic features noted in the excavations, I am largely indebted to Culbert for the formulation of the sequence of phases that is given in Table 1.

This research was carried out under two grants from the National Science Foundation to the University of Chicago, Department of Anthropology. A report stressing the interdisciplinary aspects of work carried out under the initial grant in geography, ethnobotany, linguistics, social anthropology, history and archaeology has been submitted to the National Science Foundation and privately circulated (McQuown 1959). Grateful acknowledgment is made to the Departamento de Monumentos Prehispánicos of the Instituto Nacional de Antropología e Historia of Mexico for granting permission for, and actively cooperating in, the work herein described. Thanks also are due to Franz Blom, of San Cristóbal de Las Casas, for very helpful advice on local geography and on historical and archaeological sources, and for permission to examine his unpublished collections and maps of the site of Moxviquil. During parts of the survey I was assisted by T. P. Culbert, J. E. Knudstad, and E. E. Calnek.

A description of the individual sites found in the survey, of too specialized interest to warrant inclusion in the present article, is included in the *Microfilm Collection of Manuscripts on Middle American Cultural Anthropology*. It may be ordered from the Photoduplication Department, University of Chicago Libraries, Chicago 37, Illinois.

ANDERSON, A. J. O. AND C. E. DIBBLE (TRANSLATORS)
1959 Florentine Codex: General History of the Things of New Spain, Book 9 — The Merchants, by Bernardino de Sahagún. *Monographs of the School of American Research*, No. 14, Part 10. University of Utah Press, Salt Lake City.

ARMILLAS, PEDRO
1951 Mesoamerican Fortifications. *Antiquity*, Vol. 25, No. 98, pp. 77–86. Newbury.

Díaz del Castillo, Bernal
1912 The True History of the Conquest of New Spain, Vol. 4, translated by A. P. Maudslay. *Hakluyt Society*, 2nd series, No. 30. London.

Feliciano Velázquez, P. (translator)
1945 *Códice Chimalpopoca.* Instituto de Historia, Universidad Nacional Autónoma de México, Mexico.

Flores R., E. (editor)
1955 Relación de los Pueblos que comprehende el Obispado de Chiapa remitida por Obispo Fray Juan Manuel García de Bargas y Rivera, 1774. MS, copy in library of Frans Blom, San Cristóbal de Las Casas.

Godoy, Diego de
1858 Relación hecha á Hernando Cortés, en que trata del descrubrimiento de diversas ciudades y provincias, y guerra que tuvo con los indios; y su modo de pelear; de la provinica de Chamula, de los caminos difíciles y peligrosos, y repartimiento que hizo en los pueblos. In "Historiadores Primitivos de Indias," Vol. 1, edited by Enrique de Vedia, pp. 465–70. *Biblioteca Autores Españoles*, Vol. 22. Imprenta Rivadeneyra, Madrid.

Herrera, A.
1945 *Historia general de los hechos de los Castellanos en las islas, y tierra-firme de el Mar-Oceano.* Editorial Guarania, Buenos Aires.

Kelly, Isabel and Angel Palerm
1952 The Tajin Totonac: Part 1, History, Subsistence, Shelter, and Technology. *Institute of Social Anthropology, Publication* 13. Smithsonian Institution, Washington.

Lowe, G. W.
1959 Archeological Explorations of the Upper Grijalva River, Chiapas, Mexico. *Papers of the New World Archaeological Foundation*, No. 2. Orinda.

Morley, S. G.
1938 The Inscriptions of Petén, Vol. 4. *Carnegie Institution of Washington, Publication* 437. Washington.

McQuown, N. A. (editor)
1959 Report on the "Man-in-Nature" Project of the Department of Anthropology of the University of Chicago in the Tzeltal-Tzotzil Speaking Region of the State of Chiapas, Mexico, three volumes. Department of Anthropology, University of Chicago, Chicago.

Olvera, J.
1951 Copanaguastla, Joya del Plateresco en Chiapas. *Ateneo*, Vol. 2, pp. 115–36. Tuxtla Gutiérrez.
1957 El Convento de Copanaguastla: Otra Jova de la Arquitectura Plateresca. *Tlatoani*, Vol. 11, pp. 4–13. Mexico.

Remesal, Antonio de
1932 Historia general de las Indias occidentales, y particular de le gobernación de Chiapas y Guatemala, two volumes. *Biblioteca Goathemala*, Vols. 4, 5. Sociedad de Geografía e Historia de Guatemala, Guatemala.

Schumann, E. A., Jr.
1936 A Recent Visit to Southern Mexico. *Maya Research*, Vol. 3, Nos. 3–4, pp. 296–305. New Orleans.

Smith, A. L.
1955 Archaeological Reconnaissance in Central Guatemala. *Carnegie Institution of Washington, Publication* 608. Washington.

Vogt, E. Z.
1959 Zinacantán Settlement Patterns and Ceremonial Organization. Paper presented at the 58th Annual Meeting of the American Anthropological Association, Mexico.

University of Chicago
Chicago, Ill.
May, 1960

THE COGGED STONES OF SOUTHERN CALIFORNIA

HAL EBERHART

ABSTRACT

Cogged stones are one of the few classes of artifacts which are limited in occurrence to the "middle" period of southern California's prehistory. They are stone discs, 6⅛ inches or less in diameter, characterized by grooves or indentations in the edge. On the basis of the nature of the latter and of the presence or absence of perforation they are described in four types. Some of the variations may have historical significance, but this cannot be proven with the data at hand. Few specimens have been excavated under controlled conditions. The distribution is virtually limited to the coastal drainage south of Ventura County and appears to center along the Santa Ana River Valley. According to the interpretation of coastal chronology employed, cogged stones were made during the period 6000–3500 B.C. Their use is unknown, but the absence of any pattern of wear and the conjunctions of certain of the specimens suggest that they served some ritual function.

THE ARCHAEOLOGY of California has not yielded readily to the construction of closely ordered chronological sequences. It was not until 30 years ago that any archaeologist working in the state was able to recognize sufficient change in his artifacts to postulate cultural change. Since that time a number of sequences have been established, but in the southern part of the state only a very few of the phases have been well defined. The archaeology of what might be called, roughly, the middle period of the prehistory of the southern California coast has been particularly resistant to chronological ordering. Part of the difficulty is that this middle period is more characterized by the absence of designating artifact classes than by the presence of such classes. Sites attributed to early man, such as those of Angeles Mesa, Los Angeles Man, La Brea, the San Dieguito River, and Tecolote Road Cut (Heizer 1953), while poor in artifact yield, at least are distinguished by their geologic situation. The late cultures, although not spectacular, do produce some remains of a distinctive and comparatively elaborate nature, for example, shell ornaments, carved steatite, bone tools and ornaments, and, in the south, pottery. The cultures of medium antiquity, however, have offered few classes or types of artifacts which are discriminating. The overwhelming bulk of the material from these sites is of a nondescript nature, such as simple flake and core tools, cobble hammerstones and manos, deep-basin metates. Most of the traits of the middle cultures have a long history in southern California; although their proportions vary, many of the features of 5000 B.C. may also be found in the near historic archaeology of the region.

It is the purpose of this paper to discuss one class of artifacts which evidence indicates is limited in time to this general middle phase. These artifacts are known variously as cogged stones, cog-wheel stones, cog stones, cogs, or rosette stones. Completely firm year dates cannot be placed on their life span, but an approximation can be made and their customary assemblage affiliation can be indicated, thus proving their significance as time markers. Unlike most of the associated material, cogged stones are sufficiently distinctive to be clearly recognizable, and they are of such a nature that it is unlikely that they were invented more than once. Their presence is, therefore, an unequivocal indication of cultural connection, provided, of course, that they have not been intruded by later circumstances. The stones are interesting for other reasons, as well. They are obviously a local invention since they are limited in distribution to a portion of southern California and find only approximate counterparts in appearance in other parts of the world. Their shape fails to provide substantial clues to their function and they are comparatively rare in occurrence. Thus, they present an element of the unusual and puzzling which intrigues both the popular and the scientific mind.

DESCRIPTION

Cogged stones are stone discs which take their name from the series of grooves or indentations and projections which have been formed in their edges. These artifacts range in diameter from approximately 1¾ to 6 inches and in thickness from about 1 to 2½ inches. The number of edge indentations on completed specimens varies from three to 22. A very few examples have only one or two grooves, and it is assumed that these are unfinished stones. It appears that in manufacture a finished disc was shaped first, after which the cogs were fashioned in its edge. On those specimens intended to be perforated, the hole was drilled as a final step. About one stone in six is per-

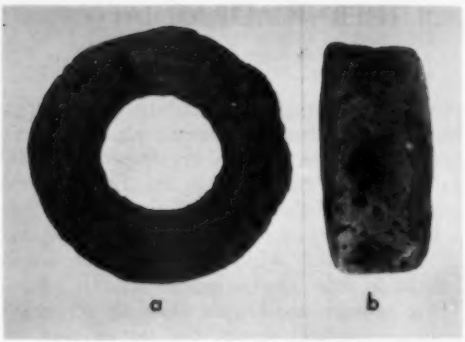

Fig. 1. Fish-vertebra type cogged stone. Found near Temecula; diameter 12.7 cm., thickness 5.6 cm.; 8 cogs (Southwest Museum No. G218–12).

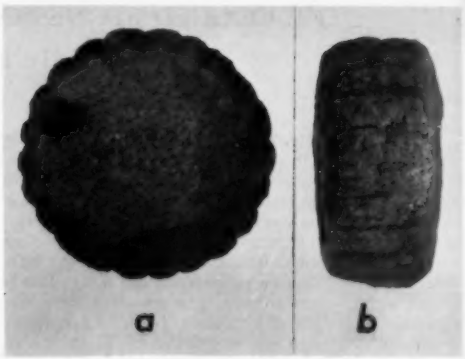

Fig. 2. Land-and-groove type cogged stone. Found in Baldwin Hills; diameter 7.7 cm., thickness 4.0 cm.; 22 cogs (Southwest Museum No. 203L6).

forated. Of the imperforate examples, one in five has pits in one or both surfaces. The materials from which the stones were made range from very soft mudstone, siltstone, and limestone, through sandstone, to hard basalt and granite. Igneous rock was preferred over metamorphic and sedimentary material by a ratio of about two to one. Steatite, a substance popular in the late period, was never used for cogged stones and is rarely associated with them.

For descriptive purposes, the stones have been classified into four types (Table 1). It cannot be shown, at present, that these have historical significance. The principal typological criterion used is the nature of the grooves or indentations (cogs) around the edge. The presence or absence of a perforation is a second criterion.

Fish-vertebra type (Fig. 1 *a, b*). The cogs are more or less hemispherical indentations in the edge of the stone; they do not break into the surfaces so that, unless the edge slopes, they are not visible when the stone is viewed from top or bottom. Of the 15 specimens of this type, 13 are perforated, one is imperforate, and one is such a small fragment that this feature cannot be determined. The imperforate specimen, which is 3.9 cm. thick, has pits 9 mm. deep ground into the center of each surface. In nine of the stones the perforations are distinctly biconical; in one the hole is conical, in one, straight. Information is lacking on the remaining two. The maximum diameter of the perforations varies between 37% and 59% of the diameter of the stones. Only four of the fish vertebra specimens are sufficiently intact that the number of cogs can be accurately determined: these have three, eight, eight, and nine. The largest number probably represented, as determined by reconstruction, is 15.

Land-and-groove type (Figs. 2 *a, b,* 3 *a, b*). At the opposite extreme, according to the typological criteria being used, are the land-and-groove stones. In this type the cogs are grooves in the edge of the stone; the grooves are of equal depth throughout their length or are deeper at the ends than in the center. Of 151 specimens of this type, only two are perforated. One of these is unusual in other respects as well. It has the greatest diameter of any stone seen: 15.5 cm. It is 4.0 cm. thick. The perforation is biconical, 4.5 cm. in diameter at the surfaces, 2.5 cm. in diameter in the center. This specimen is discus shaped; that is, thicker in the center than at the edges. It is of fine-grained sandstone, has 16 cogs, and is housed in Los Angeles County Museum (No. A2096–166). A second specimen from the same collection (No.

Table 1. Characteristics of Cogged Stones by Type*

Type	Diameter mm.			Thickness mm.			Cogs			Number
	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	
Fish-Vertebra	74	129	99	36	56	45	3	9	7	15
Land-and-Groove	50	155	88	25	53	38	4	22	11	151
Intermediate Perforated	76	137	100	38	62	45	5	14	10	16
Intermediate Imperforate	44	115	76	30	51	36	5	13	8	16
Type Not Determinable	50	127	75	25	56	35	4	17	9	62
Total										260

* Numbers in cells (except those in Number column) refer to observations on complete specimens.

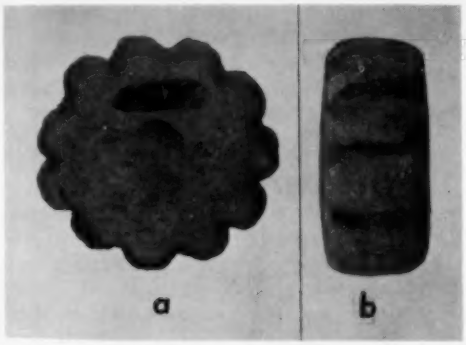

FIG. 3. Land-and-groove type cogged stone. Found in Baldwin Hills; diameter 8.7 cm., thickness 4.2 cm.; 11 cogs (Southwest Musem No. 203L6).

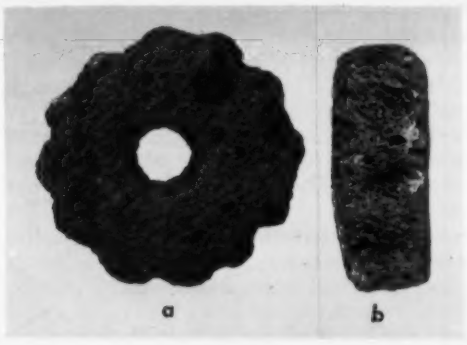

FIG. 4. Intermediate perforated type cogged stone. Provenience unknown; diameter 13.7 cm., thickness 4.8 cm.; 12 cogs (Southwest Museum).

A2096–178) is similar in shape. It is not perforated but has pits about 1.5 cm. deep drilled in the center of each surface. This second stone is 12.7 cm. in diameter and 5.3 cm. thick, the thickest land-and-groove example noted. The provenience of neither is known. The other perforated land-and-groove stone is otherwise typical of its type. The perforation is biconical, 2.8 cm. in diameter at the surfaces, 9 mm. in diameter at the center. It is illustrated by Smith (1950: 9 center). An additional 15 stones have pits of various depths, but usually shallow, pecked or drilled in the center of one or both surfaces.

Two other features associated with the land-and-groove type deserve special mention. One of these is represented on five stones, the other on one stone. Number 477 in the Bowers Memorial Museum collection has a relatively deep concavity hollowed out of one surface giving it the appearance of a small cogged mortar. It is 6.6 cm. in diameter and perhaps half that in thickness. The edge bears 14 fairly deep grooves. The provenience is listed as northern Orange County coast. It is superficially similar to a mortar from the Dalles-Deschutes region pictured by Strong, Schenck, and Steward (1930, Pl. 25 *f*). Four other mortar-like cogged stones are known to us from photographs, but the Bowers Museum specimen is the only one we have been able to examine. The second unusual specimen, known to us only from a photograph, is distinguished by a narrow, shallow ring pecked around at least one surface about one-third of the way in from the edge. The artifact appears to be of a vesicular material. It has about 18 cogs and was found near the eastern boundary of the City of San Diego.

Intermediate perforated type (Fig. 4 *a*, *b*). Two types of stones lie typologically between the fish-vertebra and land-and-groove types. In the intermediate types the grooves or indentations in the edges are deeper in the center than at the surfaces but, nevertheless, break into the surfaces and are clearly visible when the stone is viewed from top or bottom. In the former characteristic they resemble the fish-vertebra stones and in the latter, the land-and-groove specimens. Sixteen examples of the intermediate type are perforated, apparently in all cases biconically. These perforations vary in maximum diameter from 8% to 49% of the diameter of the stone.

Intermediate imperforate type. An additional 16 stones are similar to those of the type just described but are not perforated. Twelve of these specimens have small pits pecked or drilled into both — or perhaps in a few cases only one — of the surfaces. One of these stones presents a unique feature. It appears that subsequent to the manufacture of a typical disc or cogged stone, about one-third of the stone was broken away. The larger portion was then salvaged by cutting three cogs into the broken straight edge, making an eight-cogged stone, since five cogs remain on the original circumference.

Type not determinable. Largely because they are known only from incomplete descriptions or inadequate photographs, or, in a few cases because they are badly battered or broken, 62 specimens cannot be typed. The majority of these are from Orange County sites excavated in the 1930's as part of the federal relief program. Thirteen of the 62 stones are perforated, 44 are imperforate; on five information concerning this feature is lacking. Of the 13, ten are biconically perforated. One specimen, from a site in Culver City, is reported to have a square perforation (Farmer n.d.: 8). The nature of the perforation on the remaining two is unknown. Fourteen of the imperforate stones have small, shallow pits in one or both surfaces.

DISTRIBUTION

In geographic distribution, cogged stones are limited to a portion of southern California (Fig. 5). Typically they occur only in the coastal drainage area and not in the region drained internally or by the Gulf of California. In terms of published archaeological areas, their range is most closely approximated by the boundaries of Heizer's Southwestern Coast Area, and nearly all have been found well within Wallace's Coastal Province and Meighan's South Coast Region (Heizer 1949; Wallace 1955; Meighan 1959a). The area of continuous distribution of cogged stones along the coast is from the Ventura–Los Angeles county

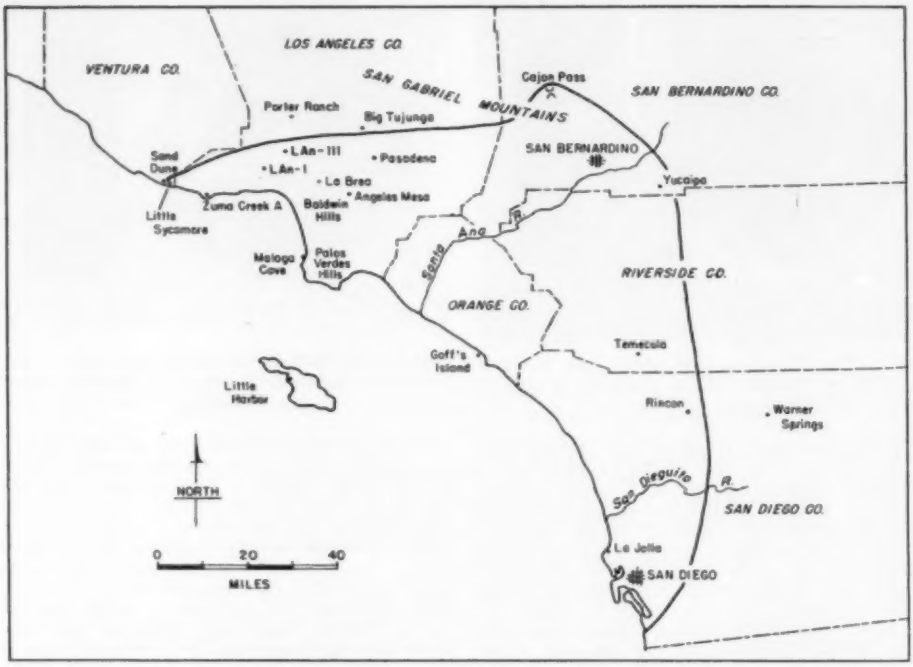

Fig. 5. Cogged stone distribution. All cogged stones on which this report is based have been found south and west of the boundary line shown on this map with the exception of a single specimen from Inyo County over 100 miles to the north.

line (Little Sycamore Shellmound) on the north to the City of San Diego on the south, although not many specimens have been reported south of central Orange County. Inland they occur commonly as far north as the San Fernando Valley, the southern margin of the San Gabriel Mountains, and Cajon Pass. The most easterly finds are from sites near the towns of Yucaipa, Temecula, and Rincon.

We do not know the precise location of many of the sites in which cogged stones have been found, but we do know the exact or approximate provenience of 230 stones. The largest number of cogged-stone sites and the sources of the majority of cogged stones are in the area within a few miles of the central and northern Orange County coast and toward the interior along the valley of the Santa Ana River. Certain hilly areas within the so-called Valley of Southern California, such as the Baldwin and Palos Verdes hills, have yielded numbers of stones. As a matter of fact, cogged stones are customarily found in sites situated on high ground — bluffs along the ocean or along streams, in hilly areas, or on knolls which rise above the plains. Only rarely are they reported from sites located on low ground. We believe that the makers of cogged stones had a predilection for living on elevations but we cannot be completely certain. The area of the heaviest concentration of cogged stones is now mainly urban and the destruction of sites has been less on elevations than in the low areas. The same situation probably prevailed in the past with respect to disturbance by natural forces, for in many places it is apparent that sites located on the valley bottoms would have been washed away or buried by flood waters.

A few cogged stones have been reported outside the region of continuous distribution. An anonymous manuscript, obviously written by a local collector, and now on file in Doheny Memorial Library, implies that cogged stones were more common in San Diego County than our data would indicate (Anonymous n.d.). The manuscript states that "types of this stone"

have been found at Warner's Ranch (Warner Springs ?), in the desert, and along the coast as far south as the Mexican border. Actually, we have been able to obtain descriptions of only three San Diego County stones: one was found on the eastern edge of the City of San Diego, one is known only to have come from somewhere within the county, and the third is reported to have been recovered near Rincon. The same manuscript tells of the discovery of one specimen in a site near Goleta, Santa Barbara County, approximately 55 miles northwest of Little Sycamore Shellmound. Treganza and Malamud (1950: 147) mention the Channel Islands in discussing cogged stone distribution. However, none of the published reports on the archaeology of the Santa Barbara Coast or Channel Islands mentions cogged stones, and we conclude that they are not characteristic of the region.

The specimen found farthest from the customary range of cogged stones is one recovered from the desert near Darwin, Inyo County. This is a typical land-and-groove stone in no way distinguishable from the examples found over 125 miles to the south. It is, of course, not too surprising to find occasional stones outside the normal range and their presence could be accounted for in any of a number of obvious ways.

Age and Association

In regard to dating and cultural association it is apparent that cogged stones are, in part at least, localized elements in the complex of semi-ancient cultures belonging to the stratum called the Milling Stone Horizon by Wallace (1955). A number of sites and cultures have been attributed to this horizon including the Oak Grove Culture of the Santa Barbara coast, Little Sycamore Shellmound, Topanga, Level 2 at Malaga Cove, and the La Jolla I shellmounds of San Diego County. Probably also to be included are Zuma Creek A, Encino or LAn–111, Porter Ranch, and possibly Culture 1 at Goff's Island. Concerning the dating of this horizon, Wallace (1955: 221) estimates that "to allow 4500–5000 years for the beginning of these simple cultures and 2000–3000 years for their duration does not seem excessive." Fieldwork reported subsequent to Wallace's publication suggests some revision in this chronology, as will be discussed below.

The people of the Milling Stone Horizon were relatively sedentary, that is, non-nomadic. They were primarily food collectors, secondarily hunters and shellfishers. The horizon takes its name from the large number of milling stones and mullers typically found in the sites. Mortars and pestles, on the other hand, are rare as are artifacts of shell and bone. The few projectile points are heavy and crude. Other artifacts frequently encountered are hammerstones, scrapers, and choppers made from cores, cobbles, or large flakes. Stone discoidals occur at a number of the sites but not in abundance.

Three sites of the Milling Stone Horizon have yielded cogged stones, namely Zuma Creek A (Peck 1955: 34–5, Pl. 11 *a-f*), Topanga (LAn–1; Treganza and Malamud 1950: 147–8, Pl. 24 *e-k*; Treganza and Bierman 1958: 65–6, Pl. 23 *a-c*), and Little Sycamore Shellmound (Wallace and others 1956: 16). The assemblages produced by Milling Stone Horizon sites are typical of the associations in which many of the cogged stones have been found. At the Pasadena Village site the latter artifacts were recovered along with stone discs, manos, and metates, but not with mortars and pestles (Holmes 1902: 182). Smith (1950: 7–8) suggests that in the San Bernardino area cogged stones may belong to the earliest culture known for the region. The remains of these people are meager but include, besides cogged stones, manos, metates, hammerstones, large choppers, scrapers, knives, and heavy projectile (dart?) points. In this area cogged stones are rarely or never associated with mortars and pestles.

Local residents in possession of cogged stones were questioned concerning the material found associated with them. Several replied that no other artifacts were recovered in the vicinity of the cogged-stone producing localities. Much of the material typical of the Milling Stone Horizon is so crude and so unlike what the average person thinks of as Indian "relics" that it is quite possible that artifacts of this horizon might be overlooked by the uninitiated casual observer. The cogged stone, on the other hand, is sufficiently noticeable to catch anyone's eye. A number of collectors who systematically search for artifacts indicated that the cogged-stone sites produced no mortars but mostly metates, manos, "chippings," and occasionally large crude points or knives and stone discs. Some opined that these sites were old, since they did not have the black, greasy soil and

small projectile points, beads, and other artifacts characteristic of sites thought to be relatively recent.

It appears that several of the cogged-stone producing sites in Orange County excavated by Winterbourne (1935, 1937, 1938) presented the problem of "horizontal" or vertical stratigraphy. This was not analyzed by Winterbourne. He did note, however, that "the stones are in most cases found in the clay completely below the camp debris" and that "rarely have they been found [directly] associated with other artifacts except the discoidal."

One cogged-stone fragment was recovered from the La Brea Pits in Los Angeles. The Tar Pits have yielded a total of 16 artifacts and part of a human skeleton. Fifteen of the artifacts, including the cogged stone and two foreshafts reportedly for use with atlatl-propelled darts, came from Pit 61–67. The foreshafts have been described in detail and the other artifacts briefly mentioned by Woodward (1937). He suggested considerable antiquity for the foreshafts, implying contemporaneity with extinct animals, but concluded that the other artifacts are more recent (compare Wallace 1955: 217).

As indicated above, Wallace dates the maximum span of the Milling Stone Horizon as 3000 B.C. to A.D. 1. This is preceded by Early Man materials dating back to the Pleistocene and is followed by the Intermediate Cultures. In the latter horizon Wallace places the Hunting Culture of the Santa Barbara coast, the Sand Dune site, La Jolla II, and, as a late manifestation, the Big Tujunga site. The Intermediate Horizon is dated between 1000 B.C. and A.D. 1000 (Wallace 1955: 223). More recent work has suggested some revision of Wallace's reconstruction and this will be discussed as it affects the dates which are to be applied to cogged stones. The Little Harbor site, excavated by Meighan in the period 1953–55, is attributed by him to the Intermediate period. This station yielded the only radiocarbon date for an Intermediate site: 1924±250 B.C. On this basis, Meighan has suggested a backward revision of the dating of the Intermediate Horizon.

> Wallace (1955: 223) expressed the generally held opinion that the Intermediate cultures occupied the time period from about 1000 B.C. to A.D. 1, but Little Harbor site forces a revision of these dates since it dates from roughly 2000 B.C. There is nothing about the site, either in its artifact inventory or the degree of midden alteration, to indicate that the site should fall toward the beginning of the Intermediate period. On the contrary, compared with other sites in southern California, Little Harbor gives a distinct impression of lateness; the Intermediate cultures must therefore date from about 1000 B.C. back to perhaps 4000 B.C. This in turn pushes back the time period for the earlier remains (Oak Grove, Topanga, and allied cultures) to a greater antiquity than has previously been considered possible. . . . We must now recognize that the deep-basin metate cultures are in part pre-Altithermal in age (greater than 7000 years B.P.) . . . (Meighan 1959b: 386).

Meighan has suggested elsewhere that Topanga dates back as far as 8000 B.C. (Meighan 1959a: 289). While the cited passages were written before publication of the second season's work at Tank Site (Treganza and Bierman 1958), the earlier date agrees well with that offered by Treganza, although the splitting of Topanga Culture into two phases could not be anticipated. On the basis of his additional work, Treganza dates Phase I of Topanga between 8000 and 4000 B.C. and Phase II from 5000 to 2500 B.C. (Treganza and Bierman 1958: 75, Table 8). Treganza's reconstruction may be viewed, in a sense, as a refinement of Wallace's chronology. He considers Lake Mohave, San Dieguito, Topanga I, and Oak Grove to be related in time and content, with each of these cultures having, respectively, slightly later beginning dates. Treganza refers to this as an early man complex, but it is later than Malaga Cove I and presumably later than the La Brea, Angeles Mesa, and Los Angeles Man material included by Wallace in his Early Man Horizon. Topanga II is believed to occupy a "middle" time position. Treganza identifies the other middle cultures as Hunting, Little Sycamore, La Jolla I and (early?) La Jolla II, Pinto-Gypsum, Malaga Cove II, Zuma Creek A, and Big Tujunga (Treganza and Bierman 1958: 45–6, Table 8). Part of the material from this last site may be this early, but part is certainly later since it contained not only cremations in stone bowls but also about forty sherds of a Rillito Red-on-brown jar characteristic of the Hohokam culture of the Tucson, Arizona, area previous to A.D. 1200 (Jennings 1956: 106; compare Walker 1951: 116). Treganza's "middle" period is thus not directly comparable with Wallace's Intermediate Horizon (compare Treganza and Bierman 1958, Table 8; Wallace 1955, Table 3). Cogged stones are not found in sites of the Intermediate Horizon as Wallace constituted it, but the implications of Treganza's

chronology would place them as contemporary with sites assignable to the earlier part of this horizon.

At Tank Site, traits of Topanga Phase II are confined to the upper 18 inches of the deposit. Phase I material extends down to 60 inches. With respect to the provenience and placement of cogged stones in the Topanga sequence, Treganza and Bierman (1958: 66) report that "the Tank Site specimens represent the earliest known occurrence, but even here their exact position as to Phase I or Phase II is not fully known. Most of our specimens occur in the top levels (0–18 inches), though a single example was found as deep as 32 inches. . . ." However, in his conclusions Treganza assigns them definitely to Phase I, although stating that they, along with stone discoidals, may not appear until late in the first phase. He does not assign them specifically to Phase II, but presumably they are a trait of the later phase since most of them were found in the upper 18 inches which contained all the Phase II material. None were found at the nearly adjacent LAn–2 site, which is exclusively Phase II, but four were recovered from Zuma Creek A which is believed to be later than Phase I and approximately contemporary with Phase II.

Thus, it is our conclusion that, as the archaeology of coastal southern California is now interpreted, cogged stones are a feature of the Milling Stone Horizon as this is manifested in Orange, Los Angeles, and western San Bernardino counties and in certain limited adjacent areas, although it is suspected that they may not be found in the earliest phase of this horizon. Also they may be present in the earlier portion of the subsequent Intermediate Horizon. In terms of the Topanga Culture, which is the best documented sequence of this early period and which, of course, extends beyond the confines of Topanga Canyon (Treganza and Bierman 1958: 49, 72; Meighan 1959a: 291), it seems to us that these artifacts might be considered conservatively as a trait of the latter half of Topanga I and of Topanga II, perhaps dropping out of use shortly before the end of the latter phase. The maximum span of the use of cogged stones might extend from 8000 B.C. to as late as 1000 B.C., but it seems much more likely that their period of use will prove to be from 6000 to 3500 B.C. While 2500 years may seem like an inordinantly long time for the existence of a time marker when compared to the 50 or so years during which some Southwestern pottery types were made, we have, at this stage in our knowledge, few other artifacts in earlier southern California archaeology which can be argued to occupy even this restricted a time span. It is possible that cogged stones, as a class, have slightly different life histories in certain portions of their range. For instance, their more abundant occurrence along the Santa Ana River may mean that they are older here than elsewhere. And, there possibly are modifications in style which may allow certain types to be dated more closely than the class as a whole can be dated, in which case it is suggested that the land-and-groove type is earliest and the fish-vertebra type the latest, and, further, that perforations are a later feature. Unfortunately, the data accompanying most of the finds of cogged stones are not sufficiently exact to permit us to do more than suggest these possibilities at the present time.

USE

The use to which cogged stones were put remains a mystery. Most writers attribute to them some undefined symbolic or ritual function (Ashby and Winterbourne 1939: 13; Smith 1950: 8; Treganza and Bierman 1958: 66; Wallace and others 1956: 16; Winterbourne 1937). This attribution is an assumption based largely on the fact that an examination of the stones themselves and the conjunctions in which they have been found produces no real clues as to how they may have been employed. However, Winterbourne discovered several of the stones in rather interesting and intriguing situations. In the period 1935–38, he excavated a number of sites in Orange County under the auspices of the federal relief programs. He filed several hundred pages of reports, mostly in the form of artifact lists. These reports are now scattered among various museums and libraries in California but no single institution has a complete set (Winterbourne 1935, 1937, 1938). Winterbourne's excavations yielded at least 55 cogged stones, more than any other excavator has found and reported. A letter written by Winterbourne to Edwin F. Walker, dated April 13, 1939, contains the following summary:

> We have noticed several peculiarities regarding this cogged discoidal. First, that the Banning Estate site seems to have produced as many of these stones as all of the other sites where they are found, combined; second, that the stones are in most cases found in the clay com-

pletely below the camp debris; third, that rarely have they been found associated with other artifacts except the discoidal; fourth, that they seem to have never served a utilitarian purpose as they are not pitted or polished and rarely broken; fifth, if broken, in almost every case the Indians attempted to mend them with asphalt; sixth, that the material used in their manufacture is with few exceptions a vesicular basalt which is found in outcrops in the San Joaquin Hills and at various points in the Santa Ana Mountains; seventh, that the number of cogs or depressions may vary from three to twenty-five or thirty-eight, that the stone may be perforated near the center of the planes or it may not be but usually there is a depression near the center of both obverse and reverse planes.

In passing it should be noted that we have not observed any stones which had been mended by the Indians nor have we been able to locate any with more than 22 cogs on the circumference, either in collections or in the literature.

The majority of Winterbourne's cogged stones came from a very large site which stretches for a couple of miles along the bluff which forms the eastern boundary of the Santa Ana River Valley near its mouth. It is not completely clear from the reports, but it appears that four separate localities in this stretch produced cogged stones. Three stones, bearing numbers N–39 through N–41, came from a site called both Norris and Banning. Thirty stones, with numbers between N–171 and N–769 (sometimes listed without the N prefix), came from a separate locality called Norris Camp. Nineteen stones, with numbers between 1624 and 1961, came from a site again referred to as Banning. This is probably a third locality, but it is possible that it is one of the two Norris sites. The fourth station is the Griset site, which yielded three stones numbered 2528, 2558, and 2572. A number of stones in Bowers Memorial Museum in Santa Ana bear numbers which fit into these four series, but their provenience on museum records refers them only to the Orange County coast.

The following excerpts from Winterbourne's notes (1935, 1937, 1938) disclose some of the peculiar situations in which certain of his cogged stones were found.

Three cogstones were uncovered (. . . N–39 and N–40 and N–41) . . . on the 39 inch level. These cogstones rested in the clay on edge, flat surfaces parallel to each other; surface planes ran north and south, plane through the center of the stones east and west. This may or may not be significant as I have found cogstones in many positions, sometimes horizontal side by side, sometimes horizontal and piled one on top of the other and in this case, three in vertical position.

These cogstones were found close to a fireplace about 2 feet square and also close to a burial. These cogstones may have had some connecting link with the fireplace and burial; this of course is not definite.

In the Norris Camp

in test hole No. 12 . . . two cogstones were uncovered. These stones were one on top of the other and rested on the clay which underlies the kitchen midden. These stones are numbered N–303 and N–304. No other artifacts were found close to these cogstones.

Cogstone N–330 was found 3 feet deep . . . in the hard clay. Chipped stones were piled on top of the cogstone. No other artifacts were found with cogstone.

A cogstone [N–331?] was found . . . at a depth of 3½ feet, 8 inches below the bottom level of the excavation in a pit. An abalone shell covered the top of the cogstone [that is, covered the 8 inch deep cache in which the cogged stone had been placed].

Three other cogstones, #468, #469 and #470, were . . . found . . . 26 inches below the surface. These stones lay in a right angle (L design); all lay flat on the clay.

Three cogstones, #554, #555 and #556, were found . . ., one on top of the other, the other 6 inches away, all on clay bottom 42 inches below the surface.

At the third of the above mentioned sites cogged stone 1830 was associated, at a depth of 31 inches, with four oblong slabs of "fossilized" limestone, a pecten shell, and a piece of blue granite. "The limestone slabs were all on the same level and their position suggests a marker of some sort" (Winterbourne 1937).

One explanation for conjunctions such as these is that in some instances cogged stones may have been buried deliberately in certain configurations or with other objects as part of a ceremony. Treganza and Bierman (1958) offer the plausible theory that cogged stones in southern California may constitute the counterpart of the spindle charmstones of the central part of the state. The charmstone was used by the more northern Indians for a variety of magico-religious purposes, and is present from earliest known times up into the historic period. Charmstones are not entirely absent from southern California sites, but they are rare.

The anonymous author mentioned previously discounts the cogged stone as an object of ceremony because it is rarely found as a burial accompaniment, a fact noted, also, by Winterbourne. It is suggested, instead, that the stones served a variety of purposes. Those with five to 18 grooves could have been used for making different kinds of ropes and fishlines. Those with deep, mortar-like cavities in one surface could have been used as lamps. Others which have a hole drilled through the center, and

have concavities around the edge, could have been used for crushing nuts and seeds. Unfortunately for the last suggestion, cogged stones, though sometimes chipped or broken, do not show any characteristic wear pattern such as should result from use as crushing or grinding tools. Some of them are made from soft sedimentary materials which would make them completely ineffectual for such purposes. Very few specimens have mortar-like depressions which would permit their use as lamps. Those which do, show no evidence of having been burned and no residue of fuel oil or grease. The suggestion that the land-and-groove stones were used in twisting strands into cord may have merit but leaves unexplained the stones of other types. No comparable device is known to us from ethnography. Stone club heads and stone heads for staves used in ceremony are reported ethnographically from various parts of the world. However, most of the perforated cogged stones have a biconical hole which tapers to such a small dimension that they would have to be hafted on a stick too slender to be of much use as a weapon. The imperforate stones could not, of course, be slipped over a shaft, although the land-and-groove specimens could form part of a flail by being tied to the end of the shaft with thongs passed through the grooves. All possibility of secular use should not be ruled out. Nevertheless, we believe that until more evidence of secular function is obtained it is best to regard the cogged stone as "ceremonial."

We do not — and probably never will — know any of the details surrounding the use of cogged stones, so that they hold little promise as aids in "cultural reconstruction." But they do have value for "historical reconstruction" for a period which has offered little of this nature. This is true of cogged stones as a class of artifacts, and if, as we suspect, style variations through time eventually can be defined then the historic types thus established may come to constitute sensitive indicators of change for a time and area notoriously lacking in such indicators.

Acknowledgments. Fewer than two dozen cogged stones have been described in the published literature. Most of the information on which this report is based has come from letters, manuscripts, field notes, personal interviews, and from examinations of stones in private collections and museums. A great many persons aided me by giving freely of their time and knowledge; among them are Robert Ariss, Agnes Babcock, F. A. Bahr, Russell E. Belous, Elizabeth Colter, William Deane, Keith Dixon, Makoto Kowta (who drafted the accompanying map), Lloyd Martin, Albert Mohr, Fred Morgan, Bert Newman, Arnold R. Pilling, E. H. Racer, Charles Rozaire, Ritner J. Sayles, Joel Shiner, Ruth DeEtte Simpson, Gerald A. Smith, Marshall Sohl, Jr., A. E. Treganza, Carr Tuthill, and J. F. White. Special thanks go to William King who freely made available to me a quantity of information that he had gathered independently. To these and others who have assisted in many ways, my deepest appreciation. I was not allowed to handle the stones housed at Bowers Memorial Museum. My data on this large collection comes from viewing the specimens in a display case and from incomplete information on provenience, size, and material supplied by the Museum.

ANONYMOUS

n.d. Orange County California Historical Research Project: Life and Customs and Peculiar Artifacts of the S. W. Coast Indians and Orange County Indians. MS, on file at Doheny Memorial Library, University of Southern California, Los Angeles.

ASHBY, G. E. AND J. W. WINTERBOURNE

1939 A Study of Primitive Man in Orange County and Some of Its Coastal Areas. Mimeographed report, on file at Southwest Museum, Los Angeles.

FARMER, M. F.

n.d. Preliminary Notes of an Archaeological Reconnaissance of Indian Camp Sites in the Baldwin Hills-Ballona Creek Region of Los Angeles County, California. MS, on file at Department of Anthropology and Sociology, University of California, Los Angeles.

HEIZER, R. F.

1949 A Bibliography of the Archaeology of California. *Reports of the University of California Archaeological Survey*, No. 4. Berkeley.

1953 Sites Attributed to Early Man in California. *Reports of the University of California Archaeological Survey*, No. 22. Berkeley.

HOLMES, W. H.

1902 Anthropological Studies in California. *Annual Report of the U.S. National Museum*, 1900, pp. 161–87. Washington.

JENNINGS, J. D. (EDITOR)

1956 The American Southwest: A Problem in Cultural Isolation. In "Seminars in Archaeology: 1955," edited by Robert Wauchope, pp. 59–127. *Memoirs of The Society for American Archaeology*, No. 11. Salt Lake City.

MEIGHAN, C. W.

1959a Californian Cultures and the Concept of an Archaic Stage. *American Antiquity*, Vol. 24, No. 3, pp. 289–305. Salt Lake City.

1959b The Little Harbor Site, Catalina Island: An Example of Ecological Interpretation in Archaeology. *American Antiquity*, Vol. 24, No. 4, pp. 383–405. Salt Lake City.

Peck, S. L.
1955 An Archaeological Report on the Excavation of a Prehistoric Site at Zuma Creek, Los Angeles County, California. *Archaeological Survey Association of Southern California*, Paper No. 2. Los Angeles.

Smith, G. A.
1950 *Prehistoric Man of San Bernardino Valley*. San Bernardino County Historical Society, Redlands.

Strong, W. D., W. E. Schenck, and J. H. Steward
1930 Archaeology of the Dalles-Deschutes Region. *University of California Publications in American Archaeology and Ethnology*, Vol. 29, No. 1. Berkeley.

Treganza, A. E. and Agnes Bierman
1958 The Topanga Culture: Final Report on Excavations, 1948. *University of California, Anthropological Records*, Vol. 20, No. 2. Berkeley.

Treganza, A. E. and C. G. Malamud
1950 The Topanga Culture: First Season's Excavation of the Tank Site, 1947. *University of California, Anthropological Records*, Vol. 12, No. 4. Berkeley.

Walker, E. F.
1951 Five Prehistoric Archaeological Sites in Los Angeles County, California. *Publications of the Frederick Webb Hodge Anniversary Publication Fund*, Vol. 6. Los Angeles.

Wallace, W. J.
1955 A Suggested Chronology for Southern California Coastal Archaeology. *Southwestern Journal of Anthropology*, Vol. 11, No. 3, pp. 214–30. Albuquerque.

Wallace, W. J. and others
1956 The Little Sycamore Shellmound, Ventura County, California. *Contributions to California Archaeology*, No. 2. Los Angeles.

Winterbourne, J. W.
1935 Orange County California Historical Research Project: Report of Banning Estate Excavation (Norris Property). MS, microfilm, Department of Anthropology and Sociology, University of California, Los Angeles.
1937 Orange County California Anthropological Project: Artifacts from Banning Site. MSS, microfilm, Department of Anthropology and Sociology, University of California, Los Angeles.
1938 Orange County California Anthropological Project. MSS, Southwest Museum, Los Angeles.

Woodward, Arthur
1937 Atlatl Dart Foreshafts from the La Brea Pits. *Bulletin of the Southern California Academy of Sciences*, Vol. 36, Part 2, pp. 41–60. Los Angeles.

Los Angeles State College
Los Angeles, Calif.
March, 1960

EARLIER STRUCTURES WITHIN THE PYRAMID OF THE SUN AT TEOTIHUACÁN *

RENÉ MILLON AND BRUCE DREWITT

ABSTRACT

A major problem in Mesoamerican prehistory is whether the gigantic Pyramid of the Sun at Teotihuacán in the Valley of Mexico was constructed in a single building operation as has long been assumed by many Mesoamerican specialists. Because the Pyramid appears to be the earliest monumental structure at Teotihuacán and because it is so immense, some archaeologists have suggested that a foreign elite was responsible for its construction. With this and other problems in mind the tunnels in the interior of the Pyramid were re-examined in 1959 for evidence of earlier structures. A modest stone-faced structure was found within it, but it is so small as not to alter significantly the conclusions of earlier investigators concerning the building of the Pyramid in one operation. However, an obsidian figurine offering found in the northwest corner of the small structure, together with other evidence, suggests that the Teotihuacán "great tradition" was coming into being early in the Tzacualli (Teotihuacán I) phase under the leadership of an incipient elite which seems to have been developing indigenously at Teotihuacán. While the problem of the enormous size of the Pyramid remains, evidence suggests that its solution lies at Teotihuacán rather than elsewhere.

THE PYRAMID of the Sun at Teotihuacán is one of the largest structures in the world (Fig. 1). It is about 215 m. by 215 m. (700 feet) at its base and a little over 64 m. (200 feet) in height. The volume of the entire structure is approximately a million cubic meters (more than 30 million cubic feet). Its interior seems to be primarily of earth. Its exterior was faced with stone and covered with lime plaster (Gamio 1922, Vol. 1: 129; Bastien 1951). Against its western face at the base is a structure known as the Plataforma Adosada which was built after the completion of the pyramid. Aside from this, the great pyramid is thought to have been raised in a single building operation (Noguera 1935: 3–7; Pérez 1935: 91–2). In this respect it differs from most of the other structures of large size which have been explored to date in Mesoamerica. Moreover, it is apparently one of the earliest, if not the earliest, monumental structures built at Teotihuacán. It was almost certainly built towards the end of the earliest phase of occupation at Teotihuacán, the Tzacualli or Teotihuacán I phase, even though some archaeologists have contended that it was built in the Miccaotli or Teotihuacán II phase (Millon 1960). The anomaly represented by this huge structure built in one operation so early in the history of Teotihuacán has often been commented on by archaeologists concerned with Mexico.

Because this problem has a bearing on the nature and population size of early Teotihuacán society, we decided that the tunnels in the Pyramid should be reinvestigated when the next opportunity arose. That opportunity came in the summer of 1959. The earliest tunnel to be dug in the Pyramid of the Sun (called here the "upper tunnel") was made under the direction of Manuel Gamio (1922). Gamio's tunnel penetrated the rear or eastern face of the first stage or platform of the pyramid, above ground level (Fig. 2). It extends horizontally from the approximate mid-line of the eastern face in a westerly direction for 97 m., where it is connected by a flight of stairs with the tunnel dug in 1933 under the direction of Eduardo Noguera (Pérez 1935). This second tunnel (called here the "lower tunnel") is some 6 m. lower than Gamio's tunnel and extends horizontally at ground level from the mid-line of the west face of the Plataforma Adosada in an easterly direction through the pyramid to the base of the stairs mentioned above. The over-all length of the resulting passage, including the connecting stairs, is about 220 m. (Fig. 2).

Pottery and figurines from the original excavations and from later collections made within the tunnel were first described by Gamio (1922) and Kroeber (1925). Noguera (1935) made a detailed study of this material following the excavation of the second tunnel. His publication is the standard report on the subject. Both tunnels are now covered with a vaulted concrete roof supported by concrete pillars, 1.6 m. high and 20 cm. wide, placed at intervals of 1.4 m. In the bays between these pillars the original fill material of the pyramid is visible, except in sections where collapses of the fill have made it necessary to wall up with rock the area between pillars. At the time of our investigation about 60% of the original fill was visible.

* An earlier draft of this paper was read at the 58th Annual Meeting of the American Anthropological Association in Mexico, December, 1959.

Because the 1957 earthquake resulted in the weakening of large sections of the lower tunnel, our major emphasis was placed on areas which were scheduled to be walled up immediately. Work was carried on during July and early August by a force which varied from three to six of our party and one to five workmen. During this time we did the following:

1. Made profile drawings of the walls of two areas in the lower tunnel, (a) a damaged area extending 34 m. to 60 m. from the gate at the western entrance, and (b) the area of the Plataforma Adosada and its juncture with the main pyramid, a section which extends from the western entrance a distance of 20 m.

2. Photographed all bays in the tunnel in which original construction material was visible.

3. Collected a sherd sample from the total length of the pyramid tunnels.

In addition an excavation was made in the floor of the lower tunnel at a point in the damaged area where evidence of a stone-faced structure was visible in the south wall of the tunnel.

To carry out this work adequate lighting had to be installed in both tunnels. This consisted of stationary 100 watt bulbs at 20 m. intervals to facilitate general coming and going, plus, for use in work areas, a number of 150 watt bulbs on extension cords and two portable banks of fluorescent lights, each consisting of four 40 watt tubes. Installation of the lighting system was made by José Monterrubio, Assistant Custodian of the Archeological Zone. The banks of fluorescent lights were designed and constructed by Alan L. McPherron of the University of Michigan. All the bays in both tunnels were numbered. A datum line was set up in each tunnel and indicated on all of the pillars.

Our findings may be briefy summarized as follows:

1. There is one undoubted stone-faced structure in the lower tunnel 55 m. from the western entrance.

2. In the northwest corner of this structure, directly behind the stone facing, an obsidian figurine offering was found. The figurine was standing in an upright position. Directly associated with it were more than 30 miniature obsidian points.

3. The Plataforma Adosada added to the front of the pyramid does not rest against an original stone facing but against an outer layer of small rectangular adobes. There was also an earlier "adosada" structure, associated with a basin or drain of some sort, within the structure now known by that name. Slope of fill lines in the Adosada section of the tunnel suggests that there may have been a still earlier structure in front of the pyramid.

4. There is evidence in the upper tunnel of one structure and at least one additional possible structure.

5. Aside from the outer facing of the pyramid mentioned above, the bays of the lower tunnel which are open indicate that the lower part of the first stage or platform of the pyramid was constructed of earth fills of varying consistency and composition. Starting at a point about 2 m. above the floor level of the lower tunnel the construction material changes to large rectangular adobes. The adobes continue to a height of almost 5 m. above the floor level of the lower tunnel near the center of the pyramid, but are interrupted by what appears to be the structure mentioned above. Whether this shift in construction material coincides with a major enlargement of the pyramid substructure or has some other special meaning is impossible to say at this point.

6. Sherd samples from the pyramid itself (exclusive of the Adosada) seem all to be of the Tzacualli phase (Teotihuacán I). However, comparison of this material with the material from the newly discovered Oztoyahualco zone to the northwest, suggests that the present Tzacualli phase may have to be divided into several subphases. The sample from the Plataforma Adosada was small but seems to conform to what we now think of as the Miccaotli phase (Teotihuacán II).

Brief comments on the first four of these findings follow.

Stone-Faced Structure. The discovery of this structure followed the examination of a diagonally sloping stone fill visible in the south wall of the lower tunnel 56 m. from the western entrance (Fig. 2). The stone fill occupies more than half of the one open bay in that section of the south wall of the tunnel. It reached to within 5 cm. of the top of the bay and was overlaid by a water-deposited layer of sand which sloped downward slightly from east to west. Between the stone fill and the earth fill to the east against which it now rests and following the slope of this junction, a narrow cross section of water-laid sand extended from approximately 10 to 50 cm. above the tunnel floor. The possible significance of this is commented on below. In short, the stone fill appeared to represent some sort of structure which sloped from the upper left part of the south bay to the lower right. No similar evi-

FIG. 1. Western face of the Pyramid of the Sun, Teotihuacán, Valley of Mexico. The Plataforma Adosada is in the left foreground. The western entrance of the tunnel through the Pyramid is at ground level just to the left of the photo.

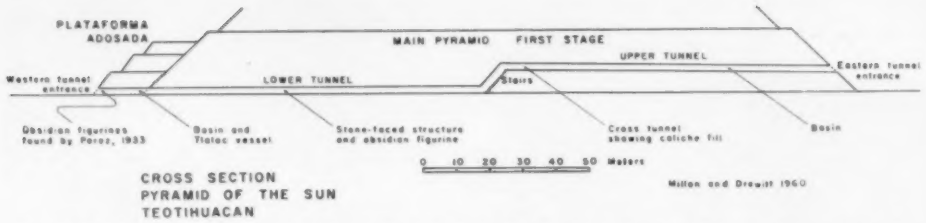

Fig. 2. Simplified cross section of the Pyramid of the Sun, Teotihuacán, showing the tunnel approximately to scale and the location of the points discussed in the text.

dence of a structure was present in the north wall of the tunnel at this point. Since the adjacent bays to the east and west on the south wall were walled up, we decided to search for further evidence of this structure in the floor of the tunnel.

Excavation in the floor revealed the top of a stone structure 75 cm. wide and 20 to 25 cm. below the present surface. We completely exposed that part of its western face which lay below the tunnel floor. It was made of unshaped stones set in mud mortar to form a relatively even surface running north-south which slanted to the west from the base to the top. That is, the slope was the reverse of that visible in the south wall. The structure when excavated was 75 cm. high and rested on dark brown compacted soil containing large pieces of indurated yellow soil known locally as *tepetate*. About 25 cm. below the base of the structure the *tepetate* inclusions in the dark brown soil became much smaller and this layer continued for 25 cm. to solid *tepetate*. The structure ends 15 cm. south of the north wall of the tunnel but is continuous with the rock fill in the south wall.

The nature of the fill immediately in front of the west face of this structure indicated that it had been exposed once before. This is curious since no published report of such an excavation exists. We tried to find out who had dug this earlier pit but so far the matter remains a mystery. It is certainly strange that whoever dug the pit did not publicize it, since the shape of the pit suggests that it was deliberately designed to expose the structure.

The stone facing seems to have formed the outer surface of an earth-filled structure, the northwest corner of which was within the lower tunnel. It is probable that part of the structure was removed when the tunnel was excavated, and that previously its facing resembled in outline the formation of stones in the south wall of the tunnel at this point. The occurrence there of the water-laid sand deposits mentioned above supports the view that the stones formed a surface sloping up from west to east which was open at the top permitting water and sand to filter down through cracks between the stones and the earth backing. The fact that the western face which was exposed in our excavation slopes in the opposite direction may be the result of warping and bowing under the pressure of subsequent fill used when the pyramid was brought to its present size. The five postholes discovered by Pérez (1935: 92) may have been associated with this structure but his account is so brief it is not possible to say.

Determination of the size and nature of this structure required further excavation in a north-south direction which we were unable to do in the time at our disposal. However, Román Piña Chán reports such excavations have since been carried out by Mexican archaeologists. Two tunnels, each approximately 15 m. long, were dug to the north and to the south at the point where we had exposed the stone structure (Fig. 2). The north tunnel confirmed our conclusion that the structure did not extend in that direction and that we had found its northwest corner in the floor of the lower tunnel. The other new tunnel exposed the structure for a distance of approximately 5 m. to the south, revealing a stone facing which was in a state of disrepair. Its maximum present height is about 1.5 m. Parts of the stone facing apparently had fallen in front of the structure and deposits of water-laid sand overlay portions of it, thus implying that it was no longer in use when the great pyramid was built. The east-west dimenison of the structure remains unknown, but it cannot have been very great.

Obsidian Figurine Offering. In the time available the interior of the structure behind the stone facing was only exposed to a depth of 60 cm. below the floor of the tunnel. The inner side of the facing was much more irregular than the outer (western) face. The obsidian figurine was found by Drewitt in the northwestern corner of the structure at the eastern, interior edge of the stone facing, about 65 cm. from the north wall of the tunnel and 70 cm. from the western face of the structure (Figs. 2, 3). The figurine is 12 cm. in height and was found standing upright, the top of its head being some 40 cm. below the surface of the tunnel floor. From its waist down the figurine was surrounded within a 6 cm. radius by scattered small obsidian fragments and by more than 30 miniature obsidian points made from flakes averaging about 1 cm. in length. A number of the points seem to have been carefully placed horizontally pointing towards the figurine (Fig. 3). Small quantities of yellow pigment, carbon, and fibrous material were found in the lightly compacted fill in which the figurine stood. About 50 cm. from the north wall of the tunnel and a little less than a meter from the western face of the structure at a depth of 35 cm. from the floor of the tunnel, we found a small cache of 7 obsidian blades standing vertically. It did not appear to be associated with the obsidian figurine. The figurine and associated points are shown in Figure 4.

The form of the figurine differs markedly from the rectilinear figurines of obsidian known from the Plataforma Adosada and elsewhere which date from the Miccaotli and later periods (compare Fig. 4 with Noguera 1935: 48; Borbolla 1947, Fig. 9; Linné 1934: 152–3; 1942: 134–5; Gamio 1922, Vol. 1, Pl. 87). Its outlines were curvilinear and both its arms and legs are similar in form to certain Preclassic figurines, specifically to some of the figurines from Tlatilco. It seems to represent a Tzacualli prototype of the later Miccaotli figurines. We hope that it may be possible to obtain some idea of the age of the figurine and associated points through the obsidian dating method.

Plataforma Adosada. Stone fill in the eastern part of the Plataforma Adosada abuts the pyramid along a sloping line beginning at floor level a little more than 11 m. from the western entrance of the lower tunnel and extending upward to a point at the top of the tunnel wall a little over 14 m. from the entrance. East from this line of juncture between the Adosada and the pyramid a section of fill which at first appeared to be compact homogeneous clayey earth extends horizontally about 3.5 m. to a low stone wall visible in cross section in both the north and south sides of the tunnel. The

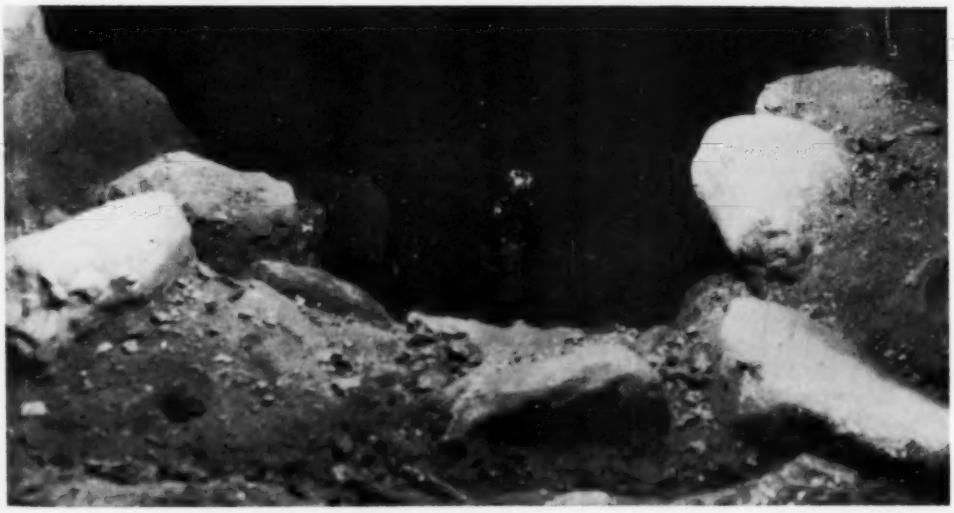

FIG. 3. Obsidian figurine found in the northwest corner of a stone-faced structure in the floor of the lower tunnel in the Pyramid of the Sun. Note miniature obsidian points around it.

wall extends above the floor of the tunnel about one meter and is about 65 to 70 cm. wide. This is still another structure of undetermined significance within the pyramid. Close examination of this homogeneous fill between the Adosada stone fill and the low wall disclosed the faint outlines of small adobe bricks when it was dampened with fine spray. These adobes are not now in completely regular courses but extend in this section from the ceiling of the tunnel to within 30 cm. of the floor. The adobes rest on a yellowish-brown soil which contains sherds and obsidian fragments. East of the low stone wall the fill changes to a dark compacted soil containing potsherds.

Whether or not the outer cap of adobes described above represents the original outer face of the pyramid before the building of the Plataforma Adosada is impossible to say without further excavations and measurements since the outer face may have been removed so that the Plataforma could be fitted into the pyramid. The slope of this juncture does not correspond to the exterior slope of the western face of the first stage of the pyramid.

Within the stone fill in the eastern part of the Adosada, beginning about 10 m. from the western entrance of the lower tunnel and extending east for about 1.5 m. a water-laid basin-shaped deposit is visible in both the south and north walls of the tunnel (Fig. 2). This deposit

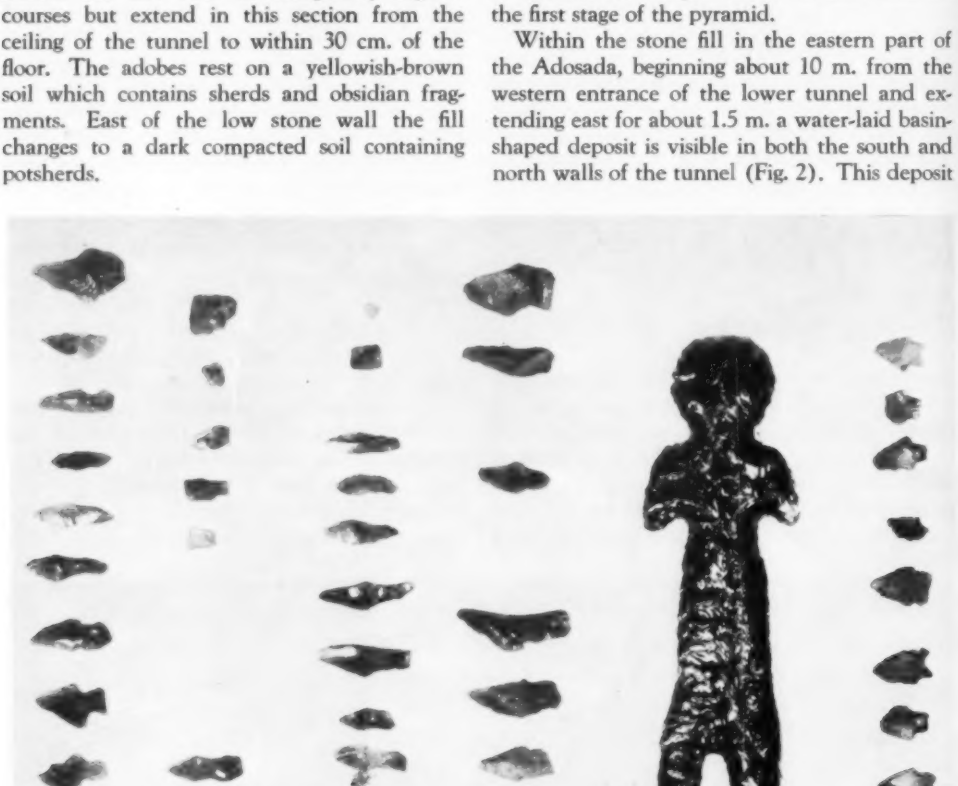

Fig. 4. Obsidian figurine from the Pyramid of the Sun and, to the left, miniature obsidian points associated with it. The figurine is 12 cm. high. See text. To the right of the figurine, miniature points from aboriginal Nevada. The Nevada points and similar points from California are relatively uniform in size and shape and appear to have served as functional points whereas the points from the Pyramid vary widely in form and size, are crudely made from thin flakes, and apparently were not intended to be used as points. They seem rather to be representations of points, perhaps specifically made to accompany the figurine in the offering. Comparative data on miniature Nevada and California points provided by A. E. Treganza, Robert F. Heizer, and Albert B. Elsasser. Photo by Elsasser.

rests on stone fill about a meter above the floor of the tunnel and apparently continues above the upper limit of the tunnel wall. The bottom of the basin at its western margin consists of a flat, smooth, thin stone at least 50 cm. wide and about 2 cm. thick which is visible in both walls of the tunnel. It continues unbroken both north and south beyond 40 cm. insets which were made in both walls to obtain sherd samples from the water-laid deposit. The western margin of the deposit is bounded by a small wall 20 to 25 cm. high resting on the rock slab. It consists of eight courses of small, carefully laid cut-stone slabs (*lajas*). The eastern margin of the basin does not appear to have such distinct limits. Instead it merges with the earth mortar of the stone fill. The material within this basin consists of alternate layers of water-laid sand and water-borne soil containing numerous potsherds. We believe that it was probably a drain running north-south in association with an earlier *adosada* structure.

The stone fill in which this basin is located ends less than a meter west of the basin. Its juncture at this point with fill consisting primarily of small chunks of *tepetate* forms a steep slope rising from east to west. The extent of this *tepetate* fill could not be determined because both sides of the tunnel are walled up to the west to a point 4 m. from the western entrance where it is no longer present. Thus, the slope of the stone fill below and to the west of the basin is the reverse of the slope of the stone fill resting against the pyramid itself. This fact plus the distinctive character of the *tepetate* fill to the west, suggests that there was possibly an even earlier structure in front of the pyramid which was altered or covered when the structure of which the drain forms a part was built.

Within the easternmost portion of the Adosada stone fill (the part which abuts on the pyramid itself), Drewitt found a complete "Tlaloc" effigy vessel in a cavity in the south wall 13 m. from the western entrance and 1½ m. above the floor of the tunnel (Fig. 2). It is cylindrical in form, 10 cm. high and a little over 5 cm. in outside diameter (Fig. 5). The vessel is unusual in that "Tlaloc" vessels of this type had not previously been found in the pyramid nor were they thought to have formed part of the Miccaotli assemblage. Of even more interest is the fact that the paste of which it was made appears to be one of the characteristic

FIG. 5. "Tlaloc" effigy vessel from the Plataforma Adosada of the Pyramid of the Sun. The vessel appears to have been made during the Tzacualli phase. It was broken after recovery. It is 10 cm. high. Photo by Leland T. Frye.

Tzacualli pastes and the vessel, therefore, presumably dates from the Tzacualli phase.

Upper Tunnel. In the upper tunnel 91 m. from the eastern entrance a short tunnel had been previously dug 4 m. north at right angles to the main tunnel (Fig. 2). In this short tunnel there is a very distinctive fill, consisting of small *caliche* chunks, which rises 1.75 m. from the tunnel floor. The northern limit of this fill, 3 m. north of the main tunnel, forms an almost perpendicular line. It abuts on an earth fill of the same height which extends to the north to the end of this short tunnel. Capping both the *caliche* and the earth fills is a thin horizontal band of earth which appears to have been a former surface. On this surface and above the *caliche* fill are three small, basin-shaped hearths filled with ash and carbon. Another possible structure in the upper tunnel appears to be some sort of small basin, con-

taining water-laid deposits and made of uncut stone. It is situated about 30 m. from the eastern entrance of the upper tunnel (Fig. 2). Nothing further on the nature, extent, and significance of these features can be stated at this time.

Conclusions

The investigations carried on in the tunnel produced unexpectedly new material in the form of the obsidian figurine-miniature projectile point complex and the "Tlaloc" vessel; it produced evidence of at least one structure of stone of relatively small size in the lower tunnel containing the obsidian figurine offering and of one or more structures in the upper tunnel; and it provided evidence of earlier structures within the Plataforma Adosada.

While it is clear that further excavations on a major scale are necessary before these discoveries can be interpreted properly, it is our impression that the evidence obtained within the Pyramid does not suggest earlier structures that are more than a tiny fraction of the size of the present Pyramid. The evidence from the lower tunnel does not suggest a prior structure of monumental size, nor does it indicate anything that resembled in form the completed pyramid. Similarly the evidence in the upper tunnel does not imply large earlier structures.

Whatever the original size and form of the structure uncovered in the lower tunnel, the presence within it of the carefully placed obsidian figurine indicates that prior to the building of the pyramid a structure of ritual significance stood on the site. The continuity manifested by this new evidence, while of great interest, is not surprising since it was a characteristically Mesoamerican practice to continue to regard a locale as sacred for long periods of time once it had become invested with ritual meaning. The sacred character of many Mesoamerican sites often survived periods of great social and cultural upheaval. What we would like to know, however, is whether the continuity expressed represents the perpetuation of an aspect of a Redfieldian "little tradition" by a submerged class under the political and religious leadership of a foreign elite, or an element of the Teotihuacán "great tradition" in the process of formation by an indigenously developing elite (compare Covarrubias 1957: 124–6, 130, 133–4, 136–7). While a definitive answer to this problem cannot be made at this time, we believe that existing evidence supports the latter point of view, namely, that there was continuity in "great tradition" between the builders of the stone-faced structure and the builders of the pyramid during the Tzacualli phase and similar continuity between the builders of the pyramid and the builders of the structures on the Street of the Dead erected during the Miccaotli phase.

The obsidian figurine offering in the northwest corner of the stone-faced structure is followed by later obsidian figurine offerings of equally obvious ritual significance in the Temple of Quetzalcoatl in the Ciudadela (Borbolla 1947: 62–5) and in the Plataforma Adosada of the Pyramid of the Sun (Pérez 1935: 91–2). Thus, during the Miccaotli phase obsidian figurines were still endowed with sufficient ritual meaning by the priests of the Pyramid of the Sun and of the Temple of Quetzalcoatl to warrant their placement in major offerings in the platform added to the great pyramid and in the main temple of the Ciudadela. The offering in the Temple of Quetzalcoatl, the most elaborately adorned temple ever built at Teotihuacán, was behind the staircase of this structure, a standard location for the placement of Teotihuacán offerings, and its location and composition (jade figurines, pyrite discs, for example) are such that it could not possibly be regarded as an offering by humble peasants. The same is true of the offering in the Plataforma Adosada. Nor do obsidian figurines appear to be the only manifestation of the beginnings of the Teotihuacán "great tradition" during the Tzacualli phase. The patron god of the Teotihuacanos, the Water God or "Tlaloc," seems now to have existed in the Tzacualli phase (see above and Millon 1960). The same is true of the Fire God, the shell trumpet, and perhaps also of the symbolic art of Teotihuacán (Millon 1960). In addition there is continuity between the Tzacualli and Miccaotli phases in the style of representation of figures of clay representing what appear to be individuals of high status (compare Covarrubias 1957: 129).

It has been argued that the great pyramids of Teotihuacán are so monumental that they could not have been conceived and built by the indigenous population of Teotihuacán and the surrounding Valley. This may be, but such an argument must reckon with the fact that the pyramids are by far the largest structures of their time in Mesoamerica. The problem of their size is a real one. But it is no solution to

postulate that architects of great pyramids immigrated from central Veracruz and supervised their building when no comparable structures existed in that region. This is not to say that the developing Teotihuacán elite may not have absorbed ideas and concepts from other peoples during the rise of Teotihuacán, nor even that small foreign elites may not have been incorporated into the Teotihuacán ruling class. But in our opinion existing evidence is insufficient to warrant the oft-repeated conclusion that Teotihuacán came under the domination of a foreign elite during either the Tzacualli or Miccaotli phases.

But is the fact that the stone-faced structure in the Pyramid of the Sun was found in a state of disrepair an argument against this interpretation? At least one distinguished Mexican archaeologist, who may not wish to be quoted, thinks so. He is of the opinion that the condition of the stone structure when the Pyramid was built indicates that there was a significant time gap between its presumed abandonment and the construction of the later pyramid. We do not feel that this necessarily follows. Despite the unexplained deterioration of the stone-faced structure, the case for continuity is too strong to be easily dismissed. Furthermore, there may be other explanations for the state of disrepair of the stone-faced structure. It is possible, for example, that the building of the great pyramid was under way before the stone-faced structure was allowed to fall into disrepair. It may be possible to arrive at a judgment on this point when the report on the new south tunnel is published.

In essence the problem at issue is the development of a complex society at Teotihuacán from simple beginnings. We feel that on the basis of existing evidence the answer to this problem is more likely to be found at Teotihuacán than elsewhere.

In sum, our limited investigations do not contradict earlier conclusions that the Pyramid of the Sun in its present form was constructed in a single building operation. While our findings suggest a continuity between the great Pyramid and an earlier structure or structures, the new evidence as it now stands does not significantly alter the conclusions of earlier investigators concerning the magnitude of the conception of the great Pyramid nor the social and technical problems involved in its construction.

If the Pyramid existed in isolation we could infer little about the nature of the society whose members built it. But the Pyramid does not exist in isolation. There is a definite continuity between Pyramid and city which makes it seem likely that the process which produced the highly stratified, significantly differentiated society of the Classic period was well under way by the time the Pyramid was built. The social implications of the construction of a building of the enormous proportions of the Pyramid of the Sun have often been exaggerated, sometimes leading to assumptions about monolithic states with authority strongly centralized in the hands of a few. Such assumptions seem to us unwarranted at this point, even though we still can say little about how integrative problems were solved in Teotihuacán society. Nevertheless, the fact remains that the construction of the Pyramid of the Sun would have involved organizational problems of a major order in a society whose population probably should be numbered in the tens of thousands rather than in the thousands (see, for example, the estimates in Brainerd 1954: 18–19).

More specific inferences about the nature of early Teotihuacán society depend on our knowing more about what sort of a settlement Teotihuacán was when the Pyramid was built. Work in the Oztoyahualco zone of Teotihuacán, northwest of the Pyramid of the Moon, in 1957 (Millon 1960) and 1959 (Millon and Bennyhoff 1961) suggests that Teotihuacán was already a settlement of some size in the Tzacualli phase. But we still know very little about the nature, numbers, and grouping of structures of this phase. In short, while more work in the Pyramid of the Sun is urgently needed, this must be coupled with work in the zone or zones of Tzacualli settlement if our understanding of early Teotihuacán society is to be significantly advanced.

Acknowledgments. The investigations reported here were conducted as part of a field training program for graduate students sponsored by the National Science Foundation. The program was directed by Millon. Drewitt worked primarily in the Pyramid during the latter part of the program and coordinated the work of the others who participated in the Pyramid investigations. Others participating during a major part of the time were Donald E. McVicker of the University of Chicago and John P. Sanchez of San Francisco State College. Patrick Hallinan and Richard R. Randolph of the University of California, Berkeley, Edward Calnek of the University of Chicago, and Alan L. McPherron of the Univer-

sity of Michigan also worked for short periods in the Pyramid tunnels. All contributed substantially to the success of these investigations and their assistance is gratefully acknowledged. We wish to thank Ignacio Bernal, Sub-Director of the Instituto Nacional de Antropología e Historia, and Román Piña Chán, Director of Monumentos Prehispánicos of the I.N.A.H. for so graciously permitting us to carry out investigations and excavations within the Pyramid of the Sun and for their willing cooperation during the course of our stay. We wish also to thank Manuel Castañeda, Custodian of the Archeological Zone of Teotihuacán, and José Monterrubio, Assistant Custodian, for their assistance and cooperation and Carmen and Don Leonard of the Centro de Investigaciones Antropológicas de México for the field facilities which they so graciously placed at our disposal. Finally, we would like to express our profound gratitude to José Luis Franco for his visit to the Pyramid tunnel and his analysis of mineral specimens from it, for his many illuminating observations on our findings, and most of all for the countless hours he spent talking about Teotihuacán and related matters with us. The preparation of this report was aided by a research grant from the National Science Foundation.

Bastien, Rémy
1951 The Pyramid of the Sun at Teotihuacan: A New Interpretation. In "The Civilizations of Ancient America," edited by Sol Tax, pp. 62–7. *Selected Papers of the XXIXth International Congress of Americanists* [New York, 1949], Vol. 1. University of Chicago Press, Chicago.

Borbolla, Daniel F. Rubín de la
1947 Teotihuacan: Ofrendas de los Templos de Quetzalcoatl. *Anales del Instituto Nacional de Antropología e Historia*, Vol. 2, 1941–46, pp. 61–72. Mexico.

Brainerd, G. W.
1954 *The Maya Civilization*. Southwest Museum, Los Angeles.

Covarrubias, Miguel
1957 *Indian Art of Mexico and Central America*. Knopf, New York.

Gamio, Manuel
1922 *La Población del Valle de Teotihuacán: La Población prehispánica*. Secretaría de Agricultura y Fomento, Dirección de Antropología, Mexico.

Kroeber, A. L.
1925 Archaic Culture Horizons in the Valley of Mexico. *University of California Publications in American Archaeology and Ethnology*, Vol. 17, pp. 373–408. Berkeley.

Linné, S.
1934 Archaeological Researches at Teotihuacan, Mexico. *Ethnographical Museum of Sweden, n.s., Publication*, No. 1. Stockholm.
1942 Mexican Highland Cultures. *Ethnographical Museum of Sweden, n.s., Publication*, No. 7. Stockholm.

Millon, René
1960 The Beginnings of Teotihuacán. *American Antiquity*, Vol. 26, No. 1, pp. 1–10. Salt Lake City.

Millon, René and J. A. Bennyhoff
1961 A Long Architectural Sequence at Teotihuacán. *American Antiquity*, Vol. 26, No. 4, in press. Salt Lake City.

Noguera, Eduardo
1935 Antecedentes y Relaciones de la Cultura Teotihuacana. *El México Antiguo*, Vol. 3, Nos. 5–8, pp. 3–90. Mexico.

Pérez, José R.
1935 Exploración del Túnel del Pirámide del Sol. *El México Antiguo*, Vol. 3, Nos. 5–8, pp. 91–2. Mexico.

University of California
Berkeley, Calif.
June, 1960

THE TIPI RINGS OF THE HIGH PLAINS

CARLING MALOUF

ABSTRACT

Stone circles known as tipi rings are a common feature of the Northern and Northwestern Plains of western North America. There are several types of stone circles: (1) a single course of stone in a simple circle; (2) more complex circles with several courses of stones; (3) circular walls made of piled-up stones; (4) corrals or forts of horizontal logs and stones; (5) stone circles of unusual size or with lines of rocks inside the circle. Studies of tipi-ring sites in Montana, Wyoming, and adjacent regions are summarized. The clusters of circles are usually found along main routes of travel and near water, fuel, and good hunting areas. Although many of these sites have been mapped, only a few of them have been excavated. Despite the paucity of cultural remains found in the excavations, the tipi-ring clusters are generally considered to be the archaeological remains of camps and villages of people who dwelt in conical, skin-covered lodges. The stones are believed to have been used to hold the skin lodge cover snug against the ground. Historical records, ethnographic observations, and the recollections of present-day Indian informants confirm these interpretations. Data from 136 recently studied tipi-ring sites along a 300-mile pipeline from Greenriver, Wyoming, to Denver, Colorado, provide further archaeological demonstration of the domestic origin of the tipi rings. Only the very small or very large rings, or those with spokes or lines of rocks through them, such as the so-called medicine wheels, are considered to have served a ceremonial purpose.

STONES arranged in circles are numerous throughout the western Plains of the United States and Canada (Fig. 1). Similar enclosures sometimes found in portions of adjoining areas, such as the Great Basin, and the Columbia Basin, may be the remains of different types of structures. Thousands of these rings must still exist in the Northern and Northwestern Plains where they are usually called "tipi rings." However, there are very few published descriptions of individual rings or clusters of rings. In the Plains the stones in a tipi ring are believed to have served to hold the bottom of the skin cover of conical structures snug against the ground. When the cover was removed the circle of stones remained. Lack of information on tipi rings has not prevented speculation about their origin and use. Many amateurs have freely expressed their ideas; most of them infer a domestic origin, as the name "tipi ring" implies. Others claim the rings were used in religious exercises, ceremonials, dances, or in games.

In recent years at least four anthropologists have made more intensive efforts to compile more adequate data on the forms and locations of tipi rings as well as the details of their clustering. Thousands of individual rings have now been mapped; some have been excavated, and collections of associated materials have been made. Perhaps the first publication to describe tipi rings in detail was a report on a Missouri River Basin archaeological project at Canyon Ferry Reservoir, near Helena, Montana (Malouf 1950a). The Canyon Ferry area is in a mountain valley about 100 miles within the Rocky Mountains, and just 30 miles from the continental divide. It is not more than 90 miles below the headwaters of the Missouri River. The prehistoric cultural manifestations are essentially Northwestern Plains in affinity through all horizons, but with occasional penetrations of traits, such as conical pestles from western Montana which are Columbia Plateau in origin. At Canyon Ferry an area of approximately 500 square miles was intensively investigated for archaeological sites of all types. Sixteen of the sites discovered were tipi-ring clusters which were usually found in three types of localities: (1) along low terraces paralleling the Missouri River, and about 25 to 40 feet above the bottomlands; (2) in low passes between mountain valleys, and on low mountain saddles or ridges which were relatively broad; (3) on terraces along permanent streams which flowed into the Missouri River.

The number of rings totaled 156 varying from one to 50 in a cluster, or an average of 11 rings per cluster. A typical ring was double-coursed (Fig. 1 *c*) rather than single-coursed (Fig. 1 *b*), and 18 feet in diameter. The rings were spread out along the edges of the wider terrace spurs, and on the crests on the narrow terraces. Most rings had a circle of stones 2 to 3 feet wide made of approximately 75 stones. There were no special openings or doorways. Double- or multiple-course rings were usually larger in diameter than were single-course rings. In the latter case the stones are merely aligned in juxtaposition. There was no evidence for overlapping or superposition, although a few rings adjoined each other.

Portions of six sites were excavated to obtain additional information. Not a single underground feature was found. There were neither fire hearths nor floor levels. Indeed, the ground immediately beneath the stones was no different than that in the center of the ring, or even outside of it. Stones were removed and the earth examined beneath them for evidences of poles or post holes. None were found. Then an effort was made to locate fire hearths outside of the tipi rings, assuming that much of the domestic activity of the inhabitants was out of doors. Trenches across entire sites, one of them 90 feet long, failed to yield a single piece of evidence of a hearth or a storage cist.

Yet there were several good indications of the domestic origin of the rings. Without exception they were located in good or explainable camping areas, and often they were near occupation sites. Usually there was good water nearby, fuel for fires, and many of them were also along what were probably main thoroughfares during aboriginal times. Even those on low mountain passes were near springs, fuel, and good hunting areas. A few sites yielded stone points and implements. At one site on a Missouri River terrace there was a cluster of five rings, and near one of these was a crude grinding stone. The rings in this case were single-coursed. On Spokane Creek, a tributary of the Missouri River, several corner-notched points of flint were found in and around a large cluster of tipi rings spread out for nearly a mile. Plano-convex scrapers were also found here attesting to the domestic, if not pacific, nature of the encampment.

A few circles had suggestions of ceremonial functions. These were among other rings and had no special locations such as on high hilltops, or in other unusual places. Some were characterized by stone lines bisecting their interiors (Fig. 1 *f*), or there were piles of stones inside, usually in the middle. In some a single rock rested in the middle of the ring. These special features, however, should not be puzzling to students who are aware that American Indians often converted simple dwellings into temporary ceremonial structures.

Partial rings (Fig. 1 *a*) indicate that the cluster was occupied not once but on several occasions when the stones were removed from an older ring and placed around a new one. Almost every tipi-ring site had partial rings.

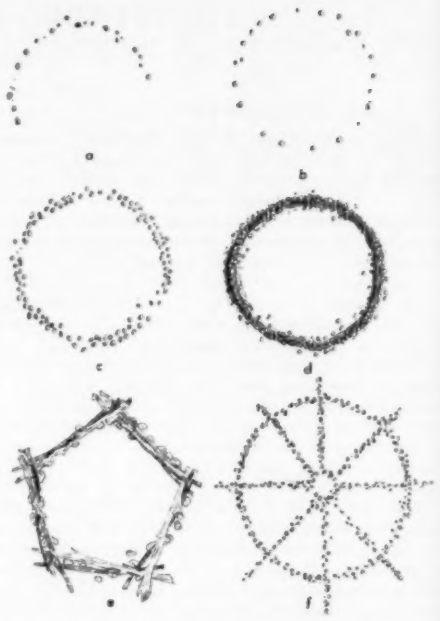

Fig. 1. Types of circular enclosures found on the Plains. *a*, partial ring; *b*, simple, or single-course ring; *c*, multiple-course ring; *d*, circular wall; *e*, corral and fort; *f*, medicine wheel.

During 1950 four brief papers appeared giving the locations of other ring sites in the Missouri River headwaters area in Montana. Some details were furnished on individual rings, but none of the sites were tested. These four papers described circles at the Gates of the Mountains, which is about 25 miles below Canyon Ferry (Forbis 1950), at Great Falls (Shumate 1950), on the Jefferson and Madison rivers, which are two of the three main streams which form the Missouri River (Thompson and Hand 1950), and on a terrace of the Big Hole River, a western tributary of the Jefferson River (Malouf 1950b).

The next step in tipi-ring studies came in 1953 when J. J. Hoffman offered a synthesis of information then available for Montana, North and South Dakota, and Wyoming (Hoffman 1953). He summarized available published sources for data on the distribution of the rings, defined 14 types of rock enclosures or formations, and discussed the possible uses of the rings.

During the following year William Mulloy (1954) published details on individual rings,

their clustering, and their relationships to topography in the Shoshone Basin, Wyoming. These rings were of piled stones in circles 11 to 20 feet in diameter. Clusters were on terrace or spurs seldom more than 50 feet away from the edge. One ring in good condition was selected for careful excavation. No floor level was found in it; only an exceedingly hard and compact gravel layer was detected. In fact, there were no signs of human activity beneath the surface. No hearths were noted, for example, and even fire-burned rocks were lacking. A few of the mapped rings were said to suggest a rectangular form with rounded corners. From this Mulloy wondered whether these were really rings after all. When the maps are examined, however, the rectangular nature of the circles becomes doubtful.

Artifact recovery at the Shoshone Basin tipi-ring sites was comparable to that at many other tipi-ring locations in the Northwestern and Northern Plains regions. Most investigators have felt that such finds, even though regarded as small, indicate an occupation of the tipi-ring site. Mulloy, however, remains skeptical of the domestic origin of tipi rings. He feels that fewer artifacts have been recovered than might be expected if the circles actually had been connected with habitations. Moreover, he feels that their locations are actually unfavorable for camping purposes. The lack of entranceways and hearths, and the variation in size are features which indicate to him a non-domestic purpose. Stones inside the circles also bother him. Why should these be found in a domestic structure? Yet, in spite of these objections the great preponderance of mapped sites shows that rings are located in favorable camping sites. Their locations vary considerably between one locality and the other, but there are always reasons for these variations. Mulloy (1958) regards rings as "problematical" or "ceremonial," and believes that possibly they are linked in some way with larger circles such as the great medicine wheel (Fig. 1 *f*) in northern Wyoming. If Mulloy is skeptical because of an alleged paucity of artifacts, then he should also regard the magnitude of the ceremonialism in the Plains which would be implied by the tremendous numbers of rings. Their quantity would indicate a ceremonialism far beyond the scope of anything known among the historic tribes in the area.

The specimens found in the Shoshone Basin by Mulloy are of significance in spite of his feeling that the yield was "too small" (Mulloy 1958: 211–3). Domestic tools which he illustrated include typical plano-convex scrapers, knives, choppers, and even a corner-notched projectile point. Many occupation sites in Montana, Wyoming, and adjoining states yield considerably less abundant specimens than those recovered by Mulloy among the Shoshone Basin tipi rings. When known historic campsites at Canyon Ferry (Malouf 1950a: 80) are examined, and at camps on the Blackfeet Reservation (Kehoe 1958) artifacts are rarely found. Roving Indian groups do not necessarily leave masses of garbage behind, and most of it was of organic materials left on the surface of the ground where it decomposed. This situation was described by trappers during the 1830's. Ferris (1940: 161) said that they passed by several recently abandoned encampments which were "occupied by bears, ravens and magpies, which were preying upon the yet undevoured particles of dried meat, and fragments of skins scattered around them." In contrast, it is common to find an increase in the amount of garbage at tipi-ring sites adjoining buffalo kills. Here, perhaps, the Indians tarried longer than usual in order to prepare meat and hides for use.

Mulloy seems to have been the first to recognize the association of small stone piles with the circles in tipi-ring sites. Unfortunately, excavation of these piles has not revealed anything regarding their purpose or origin.

The fourth major contributor to knowledge of tipi-ring functions is Thomas Kehoe (1954, 1958, 1960). In north-central Montana, and in adjoining Alberta he has mapped 210 tipi-ring sites and has noted many others. Nearly 1000 individual rings were mapped within these sites. Very few sketches of these, however, have been published. Kehoe notes that larger rings appear to be more recent while smaller rings are older. At Canyon Ferry a similar idea had been expressed, but was rejected due to insufficient data. Kehoe, however, noticed that there was less deposition in the larger rings indicating their recency. He also noticed that there was some correlation between the location of rings and physical settings favorable for camping. There were even some clusters which exhibited special community arrangements. As elsewhere

in the Plains few specimens were recovered from the tipi rings in this area.

Besides making the usual comments on the sizes, forms, and location of rings Kehoe bridges the gap between the archaeological and ethnological sources by presenting data from several Blackfoot Indian informants, and from observations of modern rings in the making. He noted that the size of the circle of stones was approximately the diameter of the tipi which it held. Moreover, both single-course and double-course rings were observed being made by modern tipi users. Single-course rings occurred when the stones were only placed around the outside of the tipi, double-course rings were made if the liner inside the lodge was also held in place with stones. Sometimes household baggage, like parfleches, was used instead of stones to hold down the liner. Some doorways in tipis were not flush with the ground, therefore it was possible to place stones immediately beneath without interfering with passage in and out of the structure. Evidently, oval doorways or slit entranceways were more common on skin tipis than they are on modern canvas or muslin tipis.

Kehoe examined the ground vacated by tipi communities and here he noticed that the heaviest packing from movements inside were in the center while the extremities were the least used. Indeed, the ground immediately outside of the tipi was often more compact than many portions of the interior. This situation is comparable to that found archaeologically. Fire hearths left scant remains except that some Indians today may use a small circle of stones to contain a hearth. Tipis in modern Blackfoot encampments vary from 7 to 30 feet in diameter with an average of 16 feet. In some instances where stones are scarce or absent the owners used sod or logs to hold down the tipi instead of rocks. As in archaeological sites the debris left behind in a modern Indian camp is very scanty. Kehoe (1958: 871) concludes: "There is no reasonable doubt that tipi rings once anchored lodge covers."

Kehoe's observations are supported in his report by similar accounts made by early explorers, trappers, and pioneers in the Plains. Remarks by Lowie (1922: 224) and Wissler 1909: 108) are also cited. However, for some undisclosed reason, he did not utilize the considerable body of data amassed by archaeologists. The studies made several years earlier at nearby Canyon Ferry, for example, were completely ignored, even though Canyon Ferry was Blackfoot territory during some of the historic period.

Perhaps the most extensive and intensive exploration for tipi rings was a study along a pipeline project between Greenriver, Wyoming, and Denver, Colorado. It was extensive because it encompassed an area several miles wide and 300 miles long; it was intensive because it was traversed with a fair degree of thoroughness. Where the pipeline passed over tipi-ring sites the archaeologist was permitted to direct the operations of heavy earth moving equipment. Thus, large areas of surface soil in and around the rings could be removed at any depth required by the archaeologist. It was an ideal opportunity to seek hearths, cache pits, or other signs of human endeavors outside of the rings as well as within them. But here, as in the case of excavations with trowels and shovels, the results were negative.

The pipeline study commenced in southwestern Wyoming where the terrain is open and somewhat barren, the western portion of the great Wyoming Basin. Occupation sites predominated, but a few tipi rings began to appear near Rock Springs, and they were found sporadically on terraces and spurs of intermittent streams as far as Rawlins, Wyoming, over 100 miles to the east. They were lacking in the intervening Red Desert. Only 16% of the sites between Rock Springs and Rawlins were tipi-ring clusters. At Rawlins, however, where the country is rougher and hillier the rings increased markedly in numbers. Between there and Greeley, Colorado, 75% of the sites were tipi-ring clusters. To the west the rings were not only sporadic and grouped in small clusters, but the individual rings were usually small ranging from 12 feet to 15 feet in diameter. Most were single-course construction. Some chips and a few worked flakes were picked up among some of the rings.

At Elk Mountain the rings increased considerably in numbers, and sites were more frequently encountered. They continued in quantity along the eastern base of the Snowy Range, but in the Laramie Valley they were lacking (Malouf 1960). Then the rings reappeared on the east side of the valley along the base of the Laramie mountains. None were in the side canyons of the Laramie range western slopes, but near the top of the mountains, even above 8000 feet elevation, small, simple rings ap-

peared in clusters of four or five. In these high elevations they were on ridges and crests rather than in drainages. Springs were always located several hundred yards away. Evidently these clusters were made mostly during favorable seasons, but were placed on higher points in order to avoid long lasting wintertime snowdrifts. Perhaps the hunters chose to remain away from the springs in order to avoid scaring game.

Lone Tree Creek flows east from the Laramie Range toward Cheyenne, Wyoming. After emerging from the mountains in the High Plains it curves south toward the South Platte River. In the mountains a few pairs of rings were located along the stream. At the mouth of the canyon, however, they immediately became more abundant, and the rings increased markedly in size. The clusters contained from 12 to 50 rings. From this place on to the South Platte River the stream passes through plains. It flows along the surface of the ground where the earth is compact, and it seeps underground over gravel areas. Wherever the stream flows on the surface of the ground there were trees for fuel and shelter, water for domestic use, and tipi rings were found; where the water disappears underground there were no tipi rings nearby. Rings were absent entirely away from streams. Many hill crests, intermittent stream beds, and other places were investigated but no sites whatsoever were found. But for 60 miles along Lone Tree Creek clusters appeared wherever the water came to the surface. Some of these clusters were very large while others were small and the numbers correlated somewhat with the quantity of water available in the vicinity. At some sites stone tools, chips, and flakes were recovered. A few points were also found, but these were somewhat scarce attesting, perhaps, to the pacific nature of the native life during the times when the rings were formed. None of the rings were made in places selected strictly for defensive purposes. At any rate, what more conclusive evidence does one need to prove the domestic origin of the rings?

Near Greeley, Colorado, rings cannot be found due to the intensive agricultural operations. Some scattered occupation sites were located in high, sandy areas all the way southward to Denver, but the search did not result in the discovery of any more rings. In all, 136 tipi-ring sites were located containing 704 circles and numerous fragments of circles. A total of 210 rings was mapped in detail. Ten sites yielded a quantity of chips, flakes, and specimens. Rock piles occurred in about a third of the tipi-ring clusters, mostly in larger groups.

Since camping situations include circumstances as well as physical surroundings, tipi rings may be found in nearly any type of locality. Some dwellings may be deliberately placed away from ponds and springs to avoid scaring game away from the water. An impending blizzard may cause a group, especially a horseless party, to make camp immediately (Kehoe 1958: 863), and often a hill crest may be selected because the wind will keep the ground bare around the dwelling instead of burying it in the drifts (Huscher and Huscher 1942: 82). Another camper might decide to place his dwelling in a low place to avoid heavy winds. Dry and waterless camps are not uncommon. Prehistoric travelers often moved between river courses rather than just up and down the streams. Herbert Sitting Crow described how in older days his people crossed the plains between the Knife River in North Dakota and the Missouri River camping on hills and crests as they moved along. These were Hidatsa and Mandan who planned their journey so they could arrive at the Missouri River bluffs about sundown where they remained overnight. "The next morning," said Sitting Crow, "they continued down to their destination in the bottomlands. The stones in the circle up above the bluffs were used to hold down their tipis."

Problems still remain regarding variations in the size of rings, in internal features, and the composition and form of the ring itself. Some consist of a simple circle of stones while others have more complex outlines. Internal features may include lines of rocks within the ring, spokes, rock piles, or perhaps a single stone may lie within the center. Ring sizes vary from 2 to 80 feet in diameter. Most are tipi size ranging from 12 to 25 feet in diameter. Others, however, extend to 30, 40 or 50 feet across suggesting that we may be observing remains of structures other than the common tipi. Internal features in some rings and unusually large numbers of stones around the periphery of the circle also demand more than the usual attention of investigators.

Structures which were somewhat different when originally built left similar forms. For

example, some circles today are remains of structures not connected with lodges or tipis at all. This is probaby the case for most rings which are over, let us say, 30 feet in diameter. Such large rings probably were not domestic in origin. The great "medicine wheel" in northern Wyoming was 80 feet across, and it had rock lines, like spokes inside the wheel (Grinnell 1922). Similar rings have been found in central Montana and these are spokes radiating out from rock cairn centers but there are no circles, and in this case they are interpreted as memorials (Kehoe 1954: 133–7).

Mulloy (1958: 171–2) has shown that some types of structures were made of logs cribbed and laid horizontally forming a corral about 35 to 50 feet across. The walls were high enough to keep horses contained. Originally they were made five- or six-sided and rocks or slabs were interspersed among the logs. When the logs ultimately disintegrated the stones which remained formed a circular outline although the structure was originally multi-sided (Fig. 1 e). Other examples of a non-tipi type of ring are found in western Montana where young prospective shamans went to hilltop circles to seek guardian spirits. There are several old Flathead, Pend d'Oreille, and Kutenai still living who received their powers at these places. When examined the circles proved to be 8 or 9 feet in diameter, and often consist of dry masonry walls laid up about 3 feet high. The suppliant crouched down on hands and knees inside the wall (Malouf and White 1953). Similar use for rings by Plains tribes, such as the Dakota, has been shown, but one must remember that these people are relatively late intruders. They did not make the original circles; they merely sought their visual experiences at some of the rings which were already made on hilltops.

That tipi rings were connected with conical structures is implied in the fact that this type of structure, with its various coverings, is basic in western North America. A four-pole, or sometimes a three-pole foundation is common to most of them; additional poles are then placed against the base poles. Different kinds of coverings were used: a dense array of additional poles, grass mats, brush, bark, skins, or a combination of these materials. Shelters of poles, brush, and earth continued to be made by Hidatsa in North Dakota, along with the standard skin-covered tipi in recent times (Wilson 1934: 411–5). The first Shoshoni met by the Lewis and Clark Expedition in 1805 were using lodges made of poles, willows, and brush (Thwaites 1904–05, Vol. 2: 334; Vol. 3: 6, 11–12, 42). Some Indians in the Columbia Plateau continued covering their conical lodges with grass mats well into the 20th century.

The Indians were capable of constructing huge conical structures; Lewis and Clark reported lodges 60 feet in diameter made of cottonwood logs about 40 feet long. One set was found on an island in the Missouri River above Great Falls, Montana, while the other was along the Yellowstone River (Thwaites 1904, Vol. 2: 241; Vol. 5: 288). The equipment and paintings within the lodge strongly indicated a ceremonial purpose was involved. No stones were mentioned in the accounts, but one can not fail to admit the possibility of rings of large size being formerly connected with unusually large conical structures.

In the Great Basin and in Southern California there are rings which probably originated as a part of a dwelling. Meighan (1955: 7) describes "House Rings" of stones in 13 of 35 sites investigated in Mono County, California. These varied from 8 to 16 feet in diameter. Some consisted of a single line of rocks while others were dry-laid walls up to 40 inches high. Some had openings toward the east. Manos, chips, potsherds, and a small amount of charcoal were associated with the circles. Meighan (1955: 7) comments: "Presumably these rings supported a brush structure of some kind although no evidence of such roofing material was found." The closed circles, he believed, could have served as a foundation for hunting blinds instead of as a house anchor or foundation.

Stone circles similar to those described by Meighan were discovered by Elmer R. Smith near Wendover, Utah. A description of these was never printed, but from my own observations they consisted of walls of light tufa which probably stood originally about 2 or 3 feet high. Few stones were in the interior and the diameters were about 12 feet. The Wendover circles were destroyed during World War II by construction work at the nearby air base. Other rings in Utah have been reported but not described (Malouf 1944: 327). Elsewhere, Renaud (1931) mentions that tipi rings were found distributed from the southern Plains across New Mexico and Arizona and into California.

At various western anthropological conferences Douglas Osborne, Earl Swanson, Alfred Bowers, and others, have mentioned the discovery of tipi rings in southern Idaho. None of these have been described; only their presence is noted.

The researches of the Huschers provide interesting information on circular, low-walled structures in western Colorado. The sites were of dry masonry, and were widely scattered, usually at relatively high altitudes on or near mountain passes. Some were on canyon rims; others were on the tips or sides of promontories overlooking valley floors, or perched on top of large talus boulders. Since these structures were of dry masonry, in constrast to the nearby Pueblo structures where adobe mortar was employed, the Huschers suspected that these buildings were of northern origin (Huscher and Huscher 1942: 82). For this reason, they thought, the placing of the circles on higher positions was regarded as traceable to the use "of windswept, snow-free sites rather than to any thought of defensive measures." While we are not concerned whether these walls had a northern origin or not the description of the remains is relevant. The walls were built of sandstone slabs or igneous boulders, whichever were available. Charcoal traces on the floor and oxydized areas on the inner wall surfaces of several ruins suggested that the structures had been burned. The charcoal recovered was in small pieces. Small juniper poles rather than heavy timbers covered with clay seem to have been used for roofing. The poles must have been set at a fairly high angle, approximately 45°, since rock slabs on the roofing had slid outward before dropping on the floor or alongside the wall. Small corner-notched points, a type unusual for this area, were found along with choppers, flake-knives, scrapers with no retouching, and some other items. Mauls, however, were lacking and pottery was rare. Pottery forms are unknown, but fine sand or ground rock had been used as tempering.

That similar structures were used in the Plains during historic times is shown by Yellowstone Kelly (Quaife 1926: 167) who observed some in 1876:

> We made very good progress up Tongue River until we came to a remarkable congregation of rude shacks, big and little, that lined one side of the valley. These were built of slabs and poles, rocks, and turf set in heterogeneous fashion, as though a large party of Indians had suddenly been attacked and driven from their camp on a freezing night and in their flight had happened on this spot and built these shacks to keep from perishing.

It is well known that war parties frequently were compelled to build forts out of rocks, logs, or both when they were repulsed by a superior military group. These varied markedly in size, form, and location according to the circumstances of the affair (Ewers 1944: 182–92; White 1952).

Lowie (1922) and Wissler (1910), have described the use of tipi rings among the Plains Indians; Jenness (1922: 79–82, 85, 91) has presented even more illuminating information on the Copper Eskimo. Rocks were used to hold small skin-covered conical structures against the ground, and "tipi rings" resulted. Rock piles in these communities, incidently, were used to elevate platforms where supplies could be kept out of the reach of foxes or dogs. Perhaps similar stone piles among Plains tipi rings in a cluster served the same purpose.

Ethnographic data do not always substantiate the use of rocks to hold down lodge covers. A Kutenai Indian, Baptiste Mathias, said his people formerly put stones around the outside of their tipis to make them invisible, magically, to enemies who might be lurking in the vicinity. A Shoshoni Indian in Idaho told Verne Ray that a circle of stones was laid where a tipi had been removed. While this latter purpose is doubtful, it has been noted by some archaeologists that there is a possibility that many of these rings in the west were made by the Shoshoni (Wedel 1948). There is correspondence between the distribution of rings and the former range of the Northern Shoshoni as well as the early Comanche. However, in eastern Idaho and western Wyoming, the heart of the Shoshoni domain, the rings are relatively scarce or lacking in many localities. Moreover, the distribution of tipi rings extends well beyond the known range of the Shoshoni particularly on the north and east. Other tribes could have made them too. Great Basin archaeologists have consistently attributed side-notched points to the Shoshoni, although this association is not proven. At any rate, most of the points found in tipi rings are corner-notched — a different type than this usually assigned to the Shoshoni.

On the positive side, other informants do attribute tipi rings to connections with dwellings. Ellen Big Sam, a Flathead born in 1879

lived the first 25 years of her life in a tipi. She says that she frequently used stones around the base of her tipi. Pegs were used too, but in a heavy wind the stones kept the spaces between the pegs close to the ground. They also served to keep out unwanted reptiles and amphibians like toads, frogs, and lizards, animals which she strongly dislikes. Another Flathead, Duncan MacDonald, born in the 1840's also said he used stones around his tipi, as did other people in his band. He added that some camps had brush, stones, and other materials piled into zig-zag lines for protection against the enemy. Thus, some tipi-ring clusters may have zig-zag rock alignments adjoining, although none have been recognized so far. Many more examples of statements from informants could be added, but these should suffice to show that the evidence is preponderantly in favor of a tipi origin for the majority of the stone circles in the Plains.

Conclusions based on present evidences strongly are in favor of a domestic origin for stone circles known as tipi rings in the Plains. Their size, form, and location together with the artifact association are too strong to deny. Historic accounts and ethnographic data support these archaeological conclusions. Since there are several types of stone circles having different purposes and functions (Fig. 1), a general term is needed to refer to all forms. For this purpose Stone Circle is used. Stone circles may be identified as Tipi Rings when the evidence suggests the circle was connected with a conical, skin-covered dwelling. The term Circular Wall is used if the stones are piled on top of each other (Fig. 1 *d*). Ceremonial Rings are stone circles with internal features, extraordinary size (large or small), and Medicine Wheel is the name of stone circles which have rock lines internally like spokes in a wheel (Fig. 1 *f*). On the archaeological level it is possible that future workers will find that coverings other than skins were used on conical frames. Since stones may have been used in the construction of these structures, the abandoned ruins might resemble a tipi ring. There is no way of distinguishing the differences at present. The tribal identity of the makers of tipi rings is not known. Groups indigenous to the Northwest Plains, such as the Flathead, Pend d'Oreille, Kutenai, and Shoshoni (and their kin, the Comanche) probably made many of them. Intruders like the Blackfoot, Crow, Hidatsa, and Mandan made others.

Ewers, J. C.
1944 The Blackfoot War Lodge: Its Construction and Use. *American Anthropologist*, Vol. 46, No. 2, pp. 182–92. Menasha.

Ferris, W. A.
1940 *Life in the Rocky Mountains*, edited by P. C. Phillips. Old West, Denver.

Forbis, R. G.
1950 Archaeological Data from the Gates of the Mountains. *Montana State University Anthropology and Sociology Papers*, No. 1, Missoula.

Grinnell, G. B.
1922 The Medicine Wheel. *American Anthropologist*, Vol. 24, No. 3, pp. 299–310. Menasha.

Hoffman, J. J.
1953 Comments on the Use and Distribution of Tipi Rings in Montana, North Dakota, South Dakota, and Wyoming. *Montana State University Anthropology and Sociology Papers*, No. 14. Missoula.

Huscher, B. H. and H. A. Huscher
1942 Athapaskan Migration via the Intermontane Region. *American Antiquity*, Vol. 8, No. 1, pp. 80–8. Menasha.

Jenness, Diamond
1922 The Life of the Copper Eskimo. *Reports of the Canadian Arctic Expedition, 1913–18*, No. 12. Ottawa.

Kehoe, T. F.
1954 Stone "Medicine Wheels" in Southern Alberta and the Adjacent Portion of Montana: Were They Designed as Grave Markers? *Journal of the Washington Academy of Sciences*, Vol. 44, pp. 133–7. Washington.
1958 Tipi Rings: The "Direct Ethnological" Approach Applied to an Archaeological Problem. *American Anthropologist*, Vol. 60, No. 5, pp. 861–73. Menasha.
1960 Stone Tipi Rings in North-Central Montana and the Adjacent Portion of Alberta, Canada: Their Historical, Ethnological, and Archeological Aspects. *Anthropological Papers*, No. 62, *Bureau of American Ethnology, Bulletin* 173, pp. 417–74. Washington.

Lowie, R. H.
1922 The Material Culture of the Crow Indians. *Anthropological Papers of the American Museum of Natural History*, Vol. 21. New York.

Malouf, Carling
1944 Thoughts on Utah Archaeology. *American Antiquity*, Vol. 9, No. 3, pp. 319–38. Menasha.
1950a The Archaeology of the Canyon Ferry Region, Montana. *Montana State University Anthropology and Sociology Papers*, No. 11. Missoula.
1950b Notes on the Archaeology of the Big Hole Region, Montana. *Montana State University Anthropology and Sociology Papers*, No. 4. Missoula.
1960 Tipi Rings. *Southwestern Lore*, Vol. 25, No. 4, pp. 3–5. Boulder.

MALOUF, CARLING AND THAIN WHITE
1953 Recollections of Lasso Stasso. *Montana State University Anthropology and Sociology Papers*, No. 12. Missoula.

MEIGHAN, C. W.
1955 Note on the Archaeology of Mono County, California. *Reports of the University of California Archaeological Survey*, No. 28. Berkeley.

MULLOY, W. T.
1954 Archaeological Investigations in the Shoshone Basin of Wyoming. *University of Wyoming Publications*, Vol. 18, Nos. 1, 2, 3. Laramie.
1958 A Preliminary Historical Outline for the Northwestern Plains. *University of Wyoming Publications*, Vol. 22, No. 1. Laramie.

QUAIFE, M. M. (EDITOR)
1926 *Yellowstone Kelly: The Memoirs of Luther S. Kelly*. Yale University Press, New Haven.

RENAUD, E. B.
1931 Archaeological Survey of Eastern Colorado. *Reports of the Archaeological Survey of the High Western Plains*, No. 1. University of Denver and University of Wyoming, Denver and Laramie.

SHUMATE, MAYNARD
1950 The Archaeology of the Vicinity of Great Falls, Montana. *Montana State University Anthropology and Sociology Papers*, No. 2. Missoula.

THOMPSON, OTTO AND SUSAN HAND
1950 Archaeological Note on the Madison and Jefferson Rivers. *Montana State University Anthropology and Sociology Papers*, No. 3. Missoula.

THWAITES, R. G. (EDITOR)
1904–05 *Original Journals of the Lewis and Clark Expedition, 1804–1806*, 8 volumes. Dodd, Mead, and Company, New York.

WEDEL, W. R.
1948 Prehistory and the Missouri Valley Development Program. *Smithsonian Miscellaneous Collections*, Vol. 111, No. 2. Washington.

WHITE, THAIN
1952 The Battle Pits of the "Koyokees." *Montana State University Anthropology and Sociology Papers*, No. 10. Missoula.

WILSON, G. L.
1934 The Hidatsa Earthlodge, edited by Bella Weitzner. *Anthropological Papers of the American Museum of Natural History*, Vol. 33, Part 5. New York.

WISSLER, CLARK
1910 Material Culture of the Blackfoot Indians. *Anthropological Papers of the American Museum of Natural History*, Vol. 5, Part 1. New York.

MONTANA STATE UNIVERSITY
Missoula, Mont.
July, 1960

A SEQUENCE OF FIGURINES FROM WEST MEXICO

GORDON L. GROSSCUP

ABSTRACT

The chronological sequence for figurine types along the west coast of Mexico has been worked out from stratigraphic excavations at Amapa, Nayarit. Twenty-seven types of figurines are defined and placed in chronological position. There is an early group correlating with the Classic period of Central Mexico, and a late group correlating with the Postclassic.

RECENT excavations near Amapa, Nayarit, Mexico, by the University of California at Los Angeles, have revealed a long sequence of occupation which parallels that revealed by Isabel Kelly's excavations (Kelly 1938) at Chametla in southern Sinaloa and those of Goldschmidt and Bordaz (U.C.L.A.) at Peñitas, about ten miles north of Amapa. Close similarities have been noted to the material found by Sauer and Brand (1932) and Fay (1959) from northern and central Nayarit. Lesser similarities can be discerned with the Guasave (Ekholm 1942) and Culiacán material (Kelly 1945a) from Sinaloa, and that of Gifford (1950) from Ixtlán del Río, southern Nayarit. A clear sequence of human figurine types is apparent from the Amapa excavations. This report will describe these types and point out some similarities to figurines from surrounding area.

A few general observations about the site of Amapa will help place the material in its natural and cultural context. Amapa lies on the coastal flood plain of western Nayarit, between the Río Grande de Santiago and the Río San Pedro. Remnants of old river channels (whether of the Río Grande or Río San Pedro is not known) occur in the immediate vicinity of the site, which lies intermediate to the historic towns of Santiago Ixcuintla and Sentispac near the villages of Amapa, Gavilán Grande and Cerritos, and is about 15 miles from the ocean. The area is flat except for slight depressions from these old channels and for artificially constructed mounds. The entire plain is subject to periodic inundation. Vegetation is semi-tropical, thorny, and dense. The fauna includes iguanas, armadillos, deer, jaguar and caiman, to mention only a few of the larger animals. Birds are abundant and fish are plentiful in the rivers. At present maize, beans, bananas and tobacco are the major crops. There are some coconuts near the coast, and cotton was once an important crop (Retes 1845). There is practically no direct archaeological evidence for agriculture at the site of Amapa; however, it would be surprising indeed if maize and beans were not grown there prehistorically. They certainly were being grown at the time of first European contact in the 1530's.

The archaeological site is named after the nearby modern village of Amapa, which was established after the breakup of the old hacienda in this area. The village church may date from the hacienda period. The village is named after a large flowering tree (*Tabebuca palmeri*, Rose) which is native to this area.

It is not known if the archaeological site of Amapa was occupied in the contact period. The recorded village of Atecomatlán (Cillan?) may be suggested as a possibility. Archaeological evidence of historic occupation is sparse and suggests the late 19th century.

Ceramically the site's occupancy may be divided into two major periods, Early and Late. More detailed ceramic analysis will undoubtedly necessitate further subdivision of these two periods. All of the constructions (mounds) tested were of Late date, and the two cemeteries excavated were also Late. Some of the mounds have cut stone staircases, adobe brick cell substructures, clay basins and, in the case of the ball court, stone wall facings. Large, cut, and sometimes decorated stone slabs were used occasionally as grave markers.

While the collections have not been extensively analyzed, it appears that the use of copper and of molcajetes is restricted to the Late Period. Two- or four-footed metates (it is not certain) and three-quarter grooved axes occur throughout. Stone projectile points occur in both periods, but are of different types. Several brief notes have been published which describe the site and some of the artifacts which were excavated there (Meighan 1959, 1960). Early Period remains were particularly common in Area B, where they lay several meters deep and under Late Period remains. They also occur in Area A and sporadically in other parts of the site.

Figurine fragments were particularly common in Area B. In part this phenomenon is

due to the greater frequency of figurine fragments in Early Period deposits. Fragments occur throughout the site, but they are least common in Area D (the ball court). The sequence of figurine types is based primarily on the evidence from four of the deeper pits in Area B (B–11, B–13, B–14, B–15). Each pit was 2 m. square and was dug in 20 cm. levels. The letters on the figures correspond to the letters used to designate each type.

By "type" I mean only that a specimen or group of specimens has traits which may be used to distinguish it or them from other specimens. These traits may be characteristics either present or absent. The cultural significance of each type is not my concern here; however, I do hope to demonstrate the chronological significance of at least some of the figurine types.

Description of the Figurines

Many mold-made figurines showing elaborate facial and body features and headdresses have been found in the northwestern part of the Valley of Mexico. They are associated with an archaeological culture called "Mazapan." Vaillant (1941: 76–9, 85) places this culture temporally between Teotihuacán Va and Aztec I, and dates it to about A.D. 1100. Figurines resembling those found in the Valley of Mexico Mazapan culture have been found in many other places in Mexico and are commonly referred to as "Mazapan figurines." Lister (1955: 34–5, 51) suggests that Mazapan figurines date from A.D. 900 to 1200. Other authors (Jennings 1956: 94) suggest that the Tula-Mazapan horizon began about A.D. 700.

There are a number of different varieties of mold-made figurines from Amapa (Types A–J). No two figurines are identical, but a number show sufficient similarities to one another or distinctiveness from the bulk of the specimens to be considered distinct typologically.

Type A. As implied above, most of the mold-made Mazapan figurines are considered as one typological unit, hereafter referred to as Type A. The common features of this type include a two-lobed headdress, a circular pendant on the chest and a V-shaped garment running from the shoulders to the waist. The hands may appear to grasp the edge of this garment or lie parallel to it. The details of the headdress and of the garment, the details of the circular pendant, and the presence or absence of breasts are variables within the type. Vaillant (1938, Fig. 2 *m*; 1941, Pl. 25) shows one Mazapan figurine which fits the type; he identifies it as a "Mazapan type from western Mexico."

No Mazapan figurine of any type is reported from Guasave (Ekholm 1942), Culiacán (Kelly 1945a), or Chametla (Kelly 1938), Sinaloa. Lister (1955: 34–5) notes a reported occurrence near Mazatlán, Sinaloa. Sauer and Brand (1932) do not report figurines of this type. As long ago as 1845, Retes (1845) noted the occurrence of figurines like those described here in the Santiago Ixcuintla area (Retes 1845, Figs. 1, 2, 17). Kelly (1949: 119, Fig. 81, Pl. 25 *e, f*) reports six Mazapan-like figurines from El Coralillo, Jalisco, which she assigns to the Coralillo complex. While these specimens share some of the Amapa features, they are clearly distinct. In the Autlán area of Jalisco Kelly (1945b: 71–2) notes one fragment of a possibly mold-made figurine from the site of Los Valantines. It could be considered a Mazapan type, but it does not fall with the Amapan specimens. Kelly assigns the site of Los Valantines to the Mylpa complex.

Lister (1949: 60) reports 27 fragments of Mazapan figurines from Cojumatlán, Michoacán. These lack the circular pendant, but are otherwise very similar to the Amapa specimens. Kelly (1947: 109, Fig. 64 *D, E*) reports seven Mazapan figurines from the Apatzingán, Michoacán area. The specimen illustrated in her Figure 64 *D* has the V-shaped garment but lacks the circular pendant, and, if the reconstruction is accurate, the double-lobed headdress. She assigns the Mazapan figurines to the Chila phase. The Zapotlán, Jalisco, reference cited by Lister (1955: 127; Kelly 1949: 119) does not mention Mazapan figurines from that area. Lister (1955: 127) also lists several occurrences in Guerrero, and cites Armillas (1948: 75), Weitlaner (1948: 81) and Ekholm (1948: 101). These sources lack illustrations, but the descriptions suggest that the reported figurines are unlike those from Amapa.

Noguera (1954: 154–65) reports a large series of Mazapan figurines from Cholula which he divides into ten types. Two of the illustrated specimens (Tipo 3e and Tipo 5g) show a V-shaped front. Two show the double-lobed headdress (Tipo 1c and Tipo 2a; Tipo 1a may be another example). None show the circular pendant. A feature of many of the Cholula specimens is the presence of perforations, one on each side, in the shoulder area. No occur-

rence of this trait is known from Amapa (although a few have ear perforations). If the Cholula examples may be considered typical of Central Mexican Mazapan figurines, it seems clear that the Amapa specimens are not trade pieces. The presence of a fragment of a mold for making Mazapan figurines at Amapa (unfortunately a surface find) attests to the fact that at least some of these figurines were made locally.

The closest resemblances to the Amapa Mazapan figurines are to be found at Ixtlán del Río. These specimens (called plaques by Gifford 1950) are surface finds, but Gifford assigns them to his Middle Period. It is interesting to note that Cojumatlán (which produced the next most similar Mazapan figurines) lies on the shores of Lake Chapala, which is part of the Río Grande system and that Ixtlán del Río and Amapa lie close to this same river. The Río Grande de Santiago, including the Río Lerma, is the longest river in Mexico, and runs from near the Valley of Mexico to the Pacific Ocean.

Our sample from Amapa consists of 53 fragmentary specimens (Fig. 1 A). All 53 are not definitely assignable to the type, but where the appropriate portion is preserved, they show the characteristics of the type. Area A produced 13 specimens. They were found in four different pits and ranged in depth from 0.40 to 4.20 m. A comparison of all figurine types suggests that several of these pits were greatly disturbed or mixed, and in one case the stratigraphy was probably reversed. Area B produced 22 specimens. They ranged in depth from 0.20 to 3.50 m., and were found in nine different pits. Area D (the ball court) produced five specimens from four pits and they ranged in depth from 0.40 to 1.60 m. Area E produced eleven specimens, from six pits, which ranged from 0.20 to 3.00 m. in depth. There are also two specimens from the surface. The mold, also found on the surface, is not included in the total count.

Type B. There is only one example of this "type" (Fig. 1 B). Unfortunately the specimen lacks the head. It shows no breast pendant and lacks the V-shaped garment. Instead, there is a suggestion of a jacket-like garment, which covers the breasts, but is open in the front, between the breasts. Cuffs or bracelets occur on both wrists. A skirt is also indicated. The specimen is from Area A, Pit C, and was found at a depth of 2.40 m.

Type C. This type is represented by the head and breast area of a single specimen (Fig. 1 C). The headdress is flat on top and probably had a rectangular outline. Its decoration suggests basketry. There appear to be bangs over the eyes, with long strands of hair hanging down on either side of the face to below the breasts. The ears are suggested by protrusions on either side of the head. Facial features are carefully delineated. The figurine is from Area B, Pit B–14, and is from 2.40 to 2.60 m. in depth. This specimen exhibits some resemblances to several figurines from Teotihuacán (Linné 1934: 118, Figs. 185, 186) which appear to date from Teotihuacán IV or V times.

Type D. This type is characterized by lack of detail (Fig. 2 *D*). All fragments are heads or portions thereof. The head has a squarish outline, a prominent nose and a raised mouth and eyes. Only one specimen defines the lips. Earplugs are usually indicated, in one case by perforations. The head is slightly depressed in the center at the top, suggesting the headdress form of Type A figurines. One aberrant specimen has a circular head (slightly depressed on top), and lacks earplugs and ears. This specimen was appliquéd to another figurine or a large vessel. Altogether there are eight specimens. Two are from pits in Area B, where they were found at depths ranging from 0.20 to 2.80 m. Six were found in two pits in Area E at depths between 0.40 and 2.65 m.

Type E. There is only one specimen of this type (Fig. 2 *E*). The head is heart-shaped in outline and earplugs are indicated. The facial features are delicately delineated in contrast to those of Type D. The specimen is from Area E, Pit E–2. The depth was not recorded.

Type F. The five specimens in this category (Fig. 2 *F*) are characterized by having body outlines very similar to those of Type A. They lack all traces of decoration or features on the body, except that four of the five are obviously pregnant; the fifth shows a trace of the chin. The form of the head of this type is not known. Two are from pits in Area A and were found at depths between 1.00 and 1.60 m. Two are from Area E and were found between 1.00 and 1.20 m. in depth. The fifth has no location. A possibly related example may be mentioned here. It is evidently a head fragment from its

outline, but it lacks any features except depressions for the eyes and mouth. However, the piece is so rough, and the depressions so minor, that their interpretation as features may be due to an active imagination. It is considered a sport or accident rather than a separate type.

Type G. There are three specimens of Type G (Fig. 1 G). They have a head which is depressed at the top and center. Two have neck length hair (?) and ears or earplugs are represented on two. Eye sockets are depressed, pupils are raised; the area around the mouth is depressed, and the mouth is raised; cheeks are prominent. All have traces of white paint; all have flat backs and are thin. One thickens at the neck and has a plug for insertion into a body. One is from Area A, Pit E, and had a depth from 3.40 to 3.60 m. The other two are from Area E, Pit E–6, and had a depth from 2.60 to 2.80 m.

Type H. While possibly not representing human beings, this type (Fig. 1 *H*) is clearly mold-made in the Mazapan tradition. There are three specimens, all of which have a pointed, elongated snout and large eyes. Two have erect, rounded ears. The specimen with-

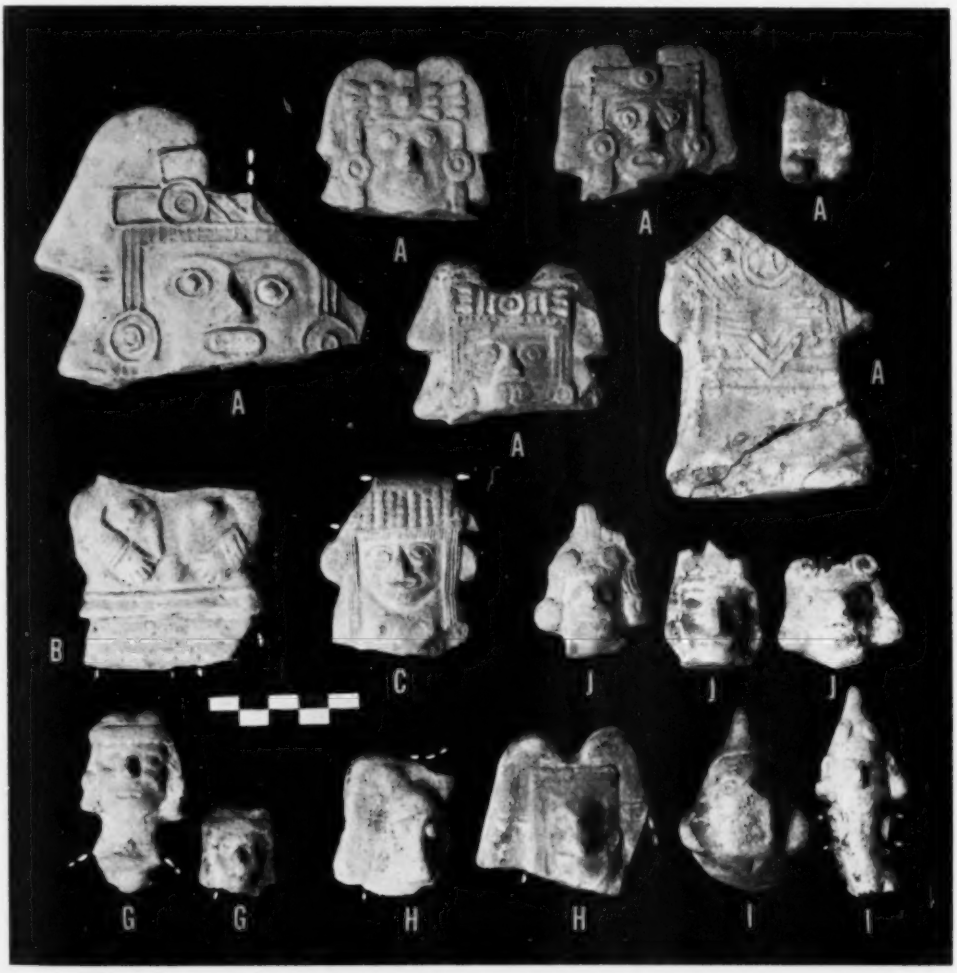

FIG. 1. Amapa figurines, Types A–C, G–J. Scale is 5 cm. long.

out ears has a headdress form typical of Type A. The other two specimens are similar to Type D in outline and simplicity of modeling. All three specimens show traces of white paint, and two also have traces of blue paint. One is from Area B at a depth of 2.60 to 2.80 m. The other two are from pits in Area A at depths ranging from 1.40 to 2.20 m. These specimens may represent humans wearing an animal mask. Unfortunately none of the specimens preserve the body form.

Type I. This type is characterized by having a single point on the top of the head (Fig. 1 *I*). There are three specimens. One is hollow with rounded back, and the face has molded eyes and nose; the mouth is a hole, penetrating into the hollow of the head. There are traces of white paint. The second specimen is solid and has a molded face and earplugs; the head rises to a single point, and the back is flat. The body and arms were apparently hand-made. There are two appliqué dots in the middle of the pointed head, and an appliqué band runs from each shoulder to an appliqué disc on the back. There are no traces of paint. The third specimen is solid and has a molded face and earplugs; the mouth is formed by a small slit. There is an appliqué band on the back of the neck and two appliqué buttons on the forehead. The top of the head is broken, but it is assumed that it rose in a single point.

One of the finds in the cemetery area (Area E) was the top of a vessel (possibly an incensario) in the form of a large seated figure, which shows a great resemblance to the figurines just described. It is hollow and entirely handmade. The mouth is an opening into the hollow interior, and the eyes are incised and closed; hair is indicated by incisions. Earplugs are present, and there is an appliqué button above each ear. A conical protuberance with a ring around its base rests on top of the head. A subrectangular plaque hangs on the chest. The left arm rests on the left knee; the right arm is raised and holds a rod. On the back there is a parachute-like attachment consisting of a disc made of a coiled piece of clay attached to three wing-like, vertical protuberances. There is a belt around the waist. Two of the figurines are from Area E, Pit E–6, and are from a depth of 0.20 to 0.60 m. The third is from Area B, Pit B–10, and from a depth of 1.60 to 1.80 m. The figure from the incensario lid(?) is from Pit E–32 and was found at a depth of 2.45 m.

Type J. The three specimens of this type (Fig. 1 *J*) have mold-made features similar to those of Type G. The somewhat rectangular head has earplugs in the lower corners. The headdress has three projections on top, and above the forehead there are two appliqué(?) buttons. The heads are flat in back, but thicken at the neck. The body form is not known. There are traces of white paint. One is from a depth of 1.40 to 1.60 m. in Area A; one from Area B at 1.40 to 1.60 m. in depth; and the third, from an unknown depth in Area E.

Type K. The nine specimens of Type K (Fig. 2 *K*) share a number of traits, chief among which are the crudity of the specimens and the lack of facial features. None have indications of eyes or a mouth; all have prominent noses, and six have protuberances for ears. Five have appliqué bands across the top of the head. One of these has two appliqué buttons affixed to the band above where the eyes should have been. All have necks, and there are traces of free arms and hand-modeled bodies. Four show traces of white paint. Two may have traces of a red slip or paint, but the color may also be due to an accident of firing. Four are from three pits in Area A and range in depth from 0.70 to 3.20 m. Another four are from a pit in Area E and range in depth from 0.20 to 1.40 m. The last specimen is a surface find.

Lister and Howard (1955, Fig. 38, right) illustrate one figurine fragment which looks like one of these figurines to which eyes and a mouth have been added.

Type L. Type L figurines are made of a flat slab of clay, and they look as if they were cut out with a cookie cutter. The features apparently are appliquéd, but they are well smoothed and blend almost perfectly with the head and body (Fig. 2 *L*).

There are at least two types of heads and two types of bodies. On one head (Type La) the eyes and mouth were made by applying a blob of clay which is then gouged out horizontally to form the pupils of the eye or the mouth opening. The alternate head (Type Lb) has the eyes and the mouth formed by gouging out a section of the base clay. The tool used for gouging the latter type appears to have been a thin, hollow cylinder. The same tool may have been used for the first type, but more probably it was flat with ribs or a rough edge which left the bottom of the gouge striated. The nose is prominent on both face types. The head is

rectangular (with two triangular exceptions) and usually each corner has a pit or a hole. Presumably the lower holes represent earplugs and the upper holes are for suspension. All specimens do not preserve these corners; however, of the 14 Type La specimens preserving a top corner, 11 are perforated all the way through and three have deep pits. Of the 14 specimens preserving a lower corner, eight are perforated all the way through and six have deep pits.

Several specimens (Type La) are slightly modeled and are thickened at the neck. Six specimens show traces of white paint on the face, the other 12, the buff paste color. Fourteen specimens have black paint in the eye gouge and one white paint; two show no traces of paint. The remaining specimen does not have its eyes preserved. Nine specimens have traces of red paint on the mouths. One showed no traces of paint and the others did not preserve this portion of the face. All four specimens which preserve part of the neck exhibit traces of red paint on it.

The one type La specimen with a body preserved is rectangular with separate slab legs which turn up at the bottom to form feet. The arms are appliquéd and form semicircles on the chest below the appliqué breasts. The arms are painted with red stripes and red paint outlines the breasts. The rest of the body is painted with intricate geometric designs in three vertical registers. The designs do not carry over to the sides or back. A blob of clay with a punched hole in its lower center is attached in the pubic region to represent the female genitals. This figurine is 18.5 cm. high, 7.5 cm. wide at the shoulders and averages about 1.0 cm. in thickness through the body.

FIG. 2. Amapa figurines, Types D–F, K–L. Scale is 5 cm. long.

Of the 15 specimens of Type Lb, 11 preserve an upper corner. Of these 11, eight are perforated and one has a pit. The other two are not altered. Twelve specimens have their lower corners intact and of these, four have perforations, six have pits and two are unaltered. One unperforated specimen has protruding ears. Four specimens show traces of red paint on or around the mouth and four specimens have traces of white paint on the face. One has a red nose. Two may have black paint in the eye gouge. One body fragment is painted red all over and has traces of white paint: this specimen is a hand-modeled, short, squat figure with no neck, and the feet are cusped. Three specimens have thickened necks and probably had bodies similar to the one just described. Two of the head fragments are thicker than the others and are more triangular in outline — the average specimen has a rectangular head.

In the collection there are eight body fragments which probably belong to either Type La, Type Lb, or both. In addition there are a number of leg fragments which will not be treated here. All of the body fragments appear to have been painted red; six show the shoulder area, and three are very similar to the nearly complete Type La specimen. One example, which has no breasts, has one forearm above the other on the chest. Two specimens had arms free from the body.

Five specimens show the pubic area, four with clay blobs in the appropriate position. Three of the blobs have a pit punched in them and presumably indicate female genitals. The fourth specimen is not punched. Kelly (1947: 106, Pl. 151, Fig. 62 *B*) suggests that a similar treatment on a figurine from Michoacán indicates a male; however, the Amapa specimen preserves one breast which is as prominent as the pubic protuberance. One specimen preserves the left leg and part of the lower body. The pubic area is damaged, but apparently the abdomen was originally swollen to represent pregnancy. The last specimen has no sexual markings.

Forty specimens of Type L were recorded. One is from Area A at a depth of 0.40 to 0.60 m. Two are from Area B at depths between 0.60 and 1.60 m. The 14 specimens from Area C were found from the surface to 1.00 m. in depth. Area D produced a single specimen at a depth of 1.00 to 1.20 m. The 18 specimens from Area E came from depths between 0.40 and 2.00 m. Of the two specimens from Area F, one was found at a depth of 0.55 m. and the other is without recorded location. Two specimens were also found on the surface.

There are a number of examples of vaguely similar figurines from surrounding areas. Published illustrations suggest no definite ties. The flatness of the form and simplicity of manufacture, plus their generally late chronological position, appear to be the main traits held in common. Neighboring occurrences include: Chalchihuites (Lister and Howard 1955: 124, Fig. 38, left), Culiacán (Kelly 1945a: Fig. 64, especially 64 n) and Autlán (Kelly 1945b: 67–9, Figs. 23, 24, Mylpa complex). A wooden figurine from Cualac, Guerrero (Muller 1955) also shows some interesting similarities.

Type M. Only one specimen is known of Type M (Fig. 3 M). It is distinctive in decorative technique and paste. The decoration consists of deep incisions, and the paste is grayish with a dark gray core. The temper is distinctive and looks to be predominantly feldspar. The preserved portion shows two parallel incised lines across the forehead and down the side of the head. The eye is formed by a short, straight, and deep incision. Below the eye and perpendicular to it are two parallel incisions which run for a short distance and then turn at right angles towards the side of the head. The piece is thickest towards the lower part of the face and tapers to the top of the head. It was found in Pit B–5 at a depth of 2.40 to 2.60 m.

Type N. There are two specimens of Type N (Fig. 3 *N*). Their most obvious characteristic is the use of a ball of clay to represent the eyeball, which is set in a coffee-bean-like socket. One of the Amapa specimens has an elliptical head, flattened at the top. Ears protrude at either side and in each there are two small pits. The nose is prominent. The top portion of the head is rough, possibly representing hair, and is not painted. The face is polished and is painted white. There is red paint under the chin, around the neck and on the ears. In profile, the head is thinnest at the top.

The second specimen lacks the upper part of the head. The ears are similar to the other example of the type, but have only one pit in each ear. The whole piece is whitish in color and it has red paint on the neck, chest, and ears. Enough remains to suggest free standing arms. One specimen was found in Area B,

Pit B–20 at a depth of 0.80 to 1.00 m. The other was found by workmen, excavating for a septic tank, over a meter below the surface.

Type O. This type (Fig. 3 O) appears to be identical to Kelly's Middle Chametla White-filleted figurine type (1938: 58–9, Pls. 17, 18). It is characterized by a white to light buff slip, a red paste, appliqué decoration, perforated ears, free arms, thin waists, appliqué breasts, and wide hips. Fifteen specimens are considered to fit in this type. Eleven of these preserve all or part of the head; six have a serrated crest on the top of the head; and three of the crests have traces of red paint. Ten heads have indications of eyes. Of these ten, two are coffee-bean in shape, and the other eight are shallow bumps on the surface of the face. Noses are prominent, and of the nine specimens with the nose portion preserved, seven have the nostrils indicated by two deep punches below or on the sides of the nose. On two specimens the mouth is indicated by two punches; seven specimens lack any indication of mouths. The ears are formed by elongating the sides of the head and perforating the projections. On one odd piece, the extension is down from the cheeks.

Of the five noncrested specimens, two have smooth, undecorated heads; one has a suggestion of two projections rising from the top of the head; another has an appliqué strip suggest-

FIG. 3. Amapa figurines, Types M–R. Scale is 5 cm. long.

ing a forelock of hair on the left side of the head and the last has a rectangular, grooved projection from the top of the head. In front of this projection there is a narrow appliqué strip which runs around behind the head where the two ends meet. This specimen, as well as one of the crested examples, has appliqué rings pendant from the ear perforations.

Seven specimens preserve part of the body of the figurine. Of the five which include the chest area, four have small appliqué breasts. The fifth specimen is aberrant in many ways and the lack of breasts is not surprising. It has a smooth head, coffee-bean eyes, no nostrils, droopy ears and squat legs. In addition it is a whistle — the head is the mouthpiece, the body forms the resonating cavity and the stop is in the middle of the back. Except for this piece, the four specimens showing a trace of arms indicate that the arm was free in the central body area and attached to the body in front of the waist or on the hips. The whistle's arms are not free. One torso has a red belt band painted around the waist and two diagonal red stripes painted across the front from the right side near the belt to the left thigh. The type is comparatively homogeneous, as it is at Chametla. I include the red painted variety with the White-filleted form. Kelly separates them. Three specimens came from Area A at depths ranging from 1.00 to 1.27 m. Nine came from Area B at depths between 1.00 and 4.60 m. Two came from Area C at depths between 0.50 and 1.00 m.

Type P. There is one specimen of this type (Fig. 3 *P*). It shares the traits of white slip, appliqué eyes and ears and lack of mouth with Type O, but it is distinctive enough to make it a separate type. It has a thick neck, no chin and tapers rapidly to the top of the head. The specimen is from Area B, Pit B–14, at a depth of from 3.20 to 3.40 m.

Type Q. There are four examples of this type (Fig. 3 *Q*). They are characterized by a triangular fore and aft cross section. The nose is the most prominent feature; the eyes and ears are slight bumps and may be appliqué. There are two varieties. Two specimens have two rounded projections on the top of the head; the other two had three projections, the center one larger than the other two. The first (bilobed) variety has white slip or paint on the head. One has a red band painted around the neck; the other has a narrow red painted band running from between the two projections, across the inner corner of its right eye and out to the tip of the nose. There is also a red dot on the front of the left projection. The second variety has an orange to buff slip. Both specimens have red paint around the neck. One has a red band running from the broken end of the central projection, between the eyes to the tip of the nose; the other has white paint on the eyes, ears and neck. There is a red dot between the eyes. All four specimens are from area B; three are from Pit B–15 and the other is from Pit B–13. All came from the same depth: 4.40 to 4.60 m.

Type R. Four specimens have been assigned to this type (Fig. 3 *R*). They are characterized by coffee-bean eyes, protruding ears (in three cases perforated), a protruding nose, orange slip, rather cylindrical shape, and a variety of headdresses composed of bands and buttons. One has a large fan-shaped headdress. One has red paint in the eyes, and another, two red stripes in an inverted V-shaped pattern below the nose. The latter specimen is from Sentispac. Three of the specimens are from three different pits in Area B. They varied in depth from 2.85 to 4.40 m. The specimen from Sentispac was found on the surface.

Type S. Kelly (1938: 57) calls this type of figurine "Smooth face." There are nine specimens from Amapa (Fig. 4 *S*). Six have no modeling to indicate the eyes; two have very slight bumps. Three have the eyes painted white (including the two with raised eyes). All have prominent noses. Ears are indicated by protuberances at the side of the head. Two have white dots to suggest a mouth; the others lack traces of mouths. All have flattened, elliptical head outlines. Two have cones protruding from the center of the top of the head; four are broken in this area and it cannot be determined whether or not they had cones. The more complete cone is hollow in the center. Appliqué forelocks occur on five examples, and possibly on two others; one has two such forelocks. The six specimens which retain a trace of the original surface have an orange slip. One specimen has red paint on the nose; another on the ears. Four have red paint on the middle of the head, including the cone on one specimen. Three have red and white paint around the neck — either alternating red and white segments or red with white dots. Three have white ears. One has a white forelock, and the

forelock on another is half red and half white. One fragment is hollow; the others appear to be solid. There are two specimens from pits in Area A. They were found at depths between 0.50 and 2.40 m. Five specimens were found in two pits in Area B at depths between 3.80 and 5.00 m. Areas D and E each produced one specimen. Both were found between 1.00 and 1.20 m.

Type T. There are four specimens which resemble Type S, but which have a more rectangular head outline and no center cone (Fig. 4 *T*). Three have slightly raised bumps for eyes; one of these has slight slits in the bumps which are painted white. All four have red paint across the eyes. On two specimens this is a solid red band clear across the face. The other two have bands that are interrupted between the eyes. Three have the ears painted white. One has red dots on the cheeks, and one has a red neck. All of the specimens have orange faces. One has a red head with a white mid-line band, the second just the white mid-line band, the third a red mid-line band, and the fourth has a white head with at least three vertical red bands on each of which are three white dots. The four specimens were found in two pits in Area B. Their depth range is from 4.00 to 4.80 m.

Type U. There are ten specimens in this rather heterogeneous group (Fig. 4 *U*). Unifying characteristics include a small punched

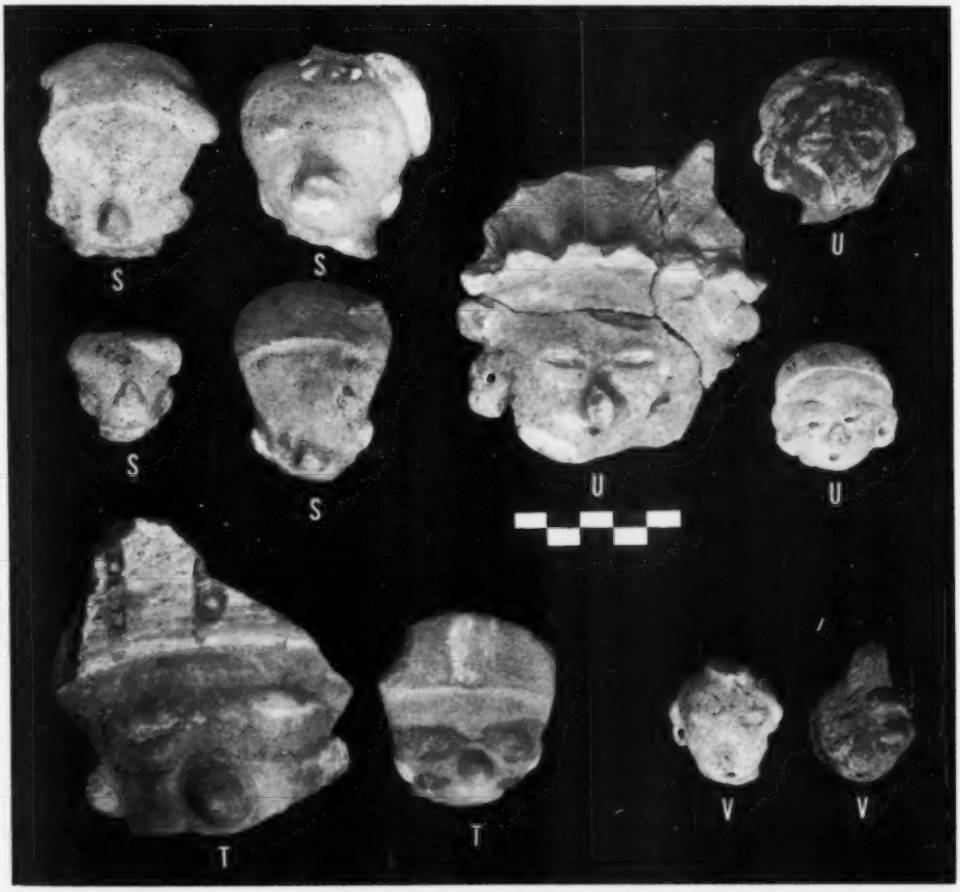

FIG. 4. Amapa figurines, Types S–V. Scale is 5 cm. long.

mouth, prominent noses, perforated ears, slightly raised eyes with horizontal or slightly diagonal slits, forelocks (like Type S), pointed crests (like Type O), ear rings (like Type O), and red mid-line head bands (like Type T) occur on some of the specimens. Faces vary from white to buff. Painted decorations include eye bands like those on Type T, as well as more elaborate examples. All but one are solid. The exception may or may not have been hollow. All ten examples are from Area B. They were found in five different pits at depths ranging from 0.60 to 4.60 m.

Type V. There are only two specimens in the following type (Fig. 4 *V*). They would fall into Type U, but differ in that they have head cones and are globular in form rather than flattened, as are Type U examples. Both specimens are from Area B, Pit B–13 and range from 4.60 to 5.00 m. in depth.

Type W. The six specimens of this type are united primarily by their unique eye and mouth form (Fig. 5 *W*). The eyes and mouth are formed by punching with a blunt object, first on one side and then on the other, leaving a slight ridge in the middle. These eyes appear, at least superficially, to look like the double punched eye of many Preclassic figurines. Two of the specimens have gray faces, and three have painted red bands pendant from one or both eyes. One of the latter has a thin diagonal red line running from the forehead, alongside of the nose to the cheek. Four of the specimens have earplugs and one has a nose ring, or what Kelly (1938: 59) calls a "nose bag." Four preserve part of the headdress, and all are different. There is one with diagonal incisions, one with appliqué buttons all over the headdress, one that has alternating red and white vertical stripes, and one that has a band of nubbins around the head and a bowl-like depression in the top of the head. One specimen of this type was found in Area A, but the depth is not known. The other five specimens are from two pits in Area B and were found between 3.20 and 5.00 m. in depth.

Type X. Most of the previous types are actually based solely on head characteristics, because the heads were preserved without bodies. The following types are based on body fragments. Type X figurine bodies are solid with arms attached to the shoulder and waist (Fig. 6 *X*). The arms may be free at the elbows. Of the 31 examples, 13 show a faint breast development. Sixteen have red belts; one has a white belt. Two have incised lines on the hands to delineate the fingers. One has the navel marked by a pit. This is the only occurrence of a navel noted in the collection. Slip color varies from white to buff and some specimens are definitely orange. Frequently the lower body and legs are painted white, presumably to indicate a skirt. There is often a red line around the neck. Red splotches also occur on the arms and chest. Four specimens are seated. One specimen was recovered from Area A at a depth of 1.80 to 2.00 m. Twenty-nine were found in six pits in Area B at depths ranging from 1.60 to 5.00 m. The remaining specimen is from Area E. It was found between 1.00 and 2.00 m.

Type Y. Type Y is represented by a unique specimen (Fig. 6 *Y*). Its form is like that of Type X. The body is unpolished and is painted or slipped red. It is also painted with a white line around the neck and three white stripes around each arm; the ankle area is also painted white. On the chest there is a D-shaped decoration, also in white, with the curved part facing down. The triangular pubic area is unpainted, but it is highly polished. The area has fired to a bright orange color. The specimen is from Area B, Pit B–14, 4.20 to 4.40 m. in depth.

Type Z. The following type is based on a sample of five specimens (Fig. 6 *Z*). The type is defined as a hollow-bodied figurine, highly polished and with a cream (or whitish) colored slip. There is red paint on the forearm and around the neck. White paint occurs below the waist on one specimen and above the red neck band on another. A third specimen has alternating red and white vertical stripes around the waist. A vertical red band may occur between the breasts. One fragment has an appliqué bracelet. The one leg preserved has a cusped foot and is painted red on the front. One head fragment is tentatively assigned to this type. It is hollow, slipped, and highly polished. Eyes are represented by a slit; the ear area is extended and contains a large perforation like Type O figurines. There is red paint below the eye and ear. All examples are from three pits in Area B. They were found at depths ranging from 2.00 to 4.20 m.

Type AA. There are twenty-four additional examples of fragments of hollow bodied figurines (Fig. 5 AA), characterized by a polished orange surface. A few examples are painted white. There are two body shapes, which may be contrasted as fat and thin. Breasts are modeled and vary in prominence. The arms are free from the body, attaching by the hands on the hips, waist or under the breasts. Decoration consists of a red neck band and bands and stripes of red on the arm, wrist and ankle (sometimes with white dots). The toes occasionally are white or red or both. There is a red band around the waist, and the legs may be painted white or left orange. All 24 examples are from four pits in Area B. They were found at depths ranging from 0.20 to 5.00 m.

Feet. There are many examples of solid legs with cusp feet. They are not given a type designation since they probably belong to several of the previous types. As will be mentioned below, they are largely restricted to the Early Period. Painting varies, but a red spot on the instep is common. The 39 specimens included in the sample are all from five pits in Area B. They were found at depths varying from 1.60 to 4.80 m.

Other specimens. There remains a heterogeneous assortment of unique specimens and small untypable fragments (Fig. 6 BB–JJ). Fur-

FIG. 5. Amapa figurines, Types W, AA. Scale is 5 cm. long.

ther study, especially of paste characteristics, will undoubtedly place some of these. Others will remain to form a miscellaneous category.

Chronology

As mentioned above the stratigraphy in Pits B–11, B–13, B–14 and B–15 serves as the basis for the suggested relative age of the various figurine types. All four pits show both Early and Late deposits. In Pit B–11 the Early material is deeper than 3.40 m.; in Pit B–13, deeper than 3.70 m.; in Pit B–14, deeper than 2.60 m.; and in Pit B–15, deeper than 2.80 m.

Type A. Of the 52 specimens, four occur in Pit B–11, four in B–13, one in B–14, and six in B–15. The B–11 specimens range in depth from 0.60 to 3.00 m., but three of these are below 2.40 m. The B–13 specimens range from 0.60 to 3.40 m. in depth, but two of the three are from below 2.60 m. The B–14 specimen is from a depth of 1.60 to 1.80 m. The B–15 specimens range from 2.00 to 2.40 m. All examples are thus from the Late deposits, but the majority are from the earlier part of these deposits. The type probably is an early Late Period trait.

Mazapan figurines have been reported from the Coralillo, Mylpa, Chila, Cojumatlán and Middle Ixtlán del Río phases. Kelly (1947: 109) points out that mold-made figurines appear in the penultimate phase in the Tuxcacuesco area (Coralillo). This observation holds true for Ixtlán del Río and, in a general way, for Amapa. On the other hand Kelly (1947: 109–10) places the Chila phase as the latest in the Apatzingán area, and the Mylpa phase as the latest in the Autlán area. Lister (1949: 60) reported mold-made figurines throughout the Cojumatlán deposits. The chronological placement of these three phases is not fixed beyond question. Possibly the twofold division suggested by Kelly (1947: 42–3) for Chila may be the answer; however, she does not suggest that Mazapan figurines are associated with only one or the other of these two subdivisions. The one, aberrant mold-made figurine from the Mylpa phase cannot help solve the problem. The Cojumatlán report (Lister 1949) does not tell us if there is a frequency change in the occurrence of mold-made figurines from Early to Late Cojumatlán, but only notes that they were found from bottom to surface. The possibility remains that Mazapan figurines are still useful as a time marker for the next to last prehistoric phase in West Mexico.

Type B. There is only one specimen of this type and it did not come from Area B. Like Type A, it is a Mazapan variant and it is probable that it dates from the same period as that type.

Type C. The single example of this type came from Pit B–14 in the deepest Late level. It is considered to be early Late Period in date.

Type D. The only Type D specimen from one of the Area B pits came from the 2.60-to-2.80-m. level of Pit B–11. This depth suggests that the type is assignable to the early part of the Late Period.

Types E, F, and G. These types did not occur in Area B pits. They are all Mazapan figurines variants and hence are assigned tentatively to the Late Period.

Type H. One specimen of this type is from level 2.60 to 2.80 m. in Pit B–13. This depth in this pit suggests an early Late Period date.

Type I. This type does not occur in Area B. From its Mazapan affinities and shallow occurrences in Area E deposits it is considered to be a Late Period type.

Type J. While one specimen comes from Area B, it was found in a mixed deposit (Pit B–10) and cannot be placed on stratigraphic evidence. It shows Mazapan affinities and is therefore considered to belong to the Late Period.

Type K. No specimens of this type occurred in Area B. The type is not a Mazapan variant and therefore it cannot be dated stylistically. With only one exception, all examples of this type were found less than 2 m. deep. It is suggested, therefore, that this type belongs to the Late Period.

Type L. Only one example of any Type L variety was recovered from one of our crucial four pits. This specimen came from the 0.60-to-0.80-m. level of Pit B–11. This depth, plus the generally shallow position of the occurrences in other areas of the site, suggests a Late Period date for the type, possibly late in the Late Period.

Type M. The single Type M specimen came from the 2.40-to-2.60-m. level of Pit B–5. Although this level is near the base of the deposits in this pit, the associated ceramics appear to be early Late Period types.

Type N. The Type N specimens cannot be placed stratigraphically. On stylistic grounds

they are presumed to date from the Early Period.

Type O. There are eight specimens of this type from the four stratigraphic pits. They are all from the upper half of the Early Period deposits and are considered to date from the late Early Period. At Chametla they date from the Middle Period.

Type P. The single Type P example is from the 3.20-to-3.40-m. level in Pit B–14. This depth, plus the resemblances of this type to Type O, suggest a late Early Period date.

Type Q. The four specimens constituting this type are all from the 4.40-to-4.60-m. level of Pits B–13 and B–15. This level is approximately in the middle of the Early deposits and suggests a middle Early Period date for the type.

Type R. Two examples of this type came from the four stratigraphic pits. All are from the lower half of the Early deposits. A date in the early part of the Early Period is suggested.

Type S. The five examples of this type came from the four stratigraphic pits. All are from the lower half of the Early deposits, suggesting a date early in the Early Period.

Type T. All four of the Type T specimens are from the four stratigraphic pits. Since they are all from the lower half of the Early deposits, an early Early Period date is suggested.

Type U. Nine Type U specimens were found in the upper half of the Early deposits in the four stratigraphic pits. A late Early date is suggested.

Type V. The two specimens of this type are from the two deepest levels of Pit B–13 and

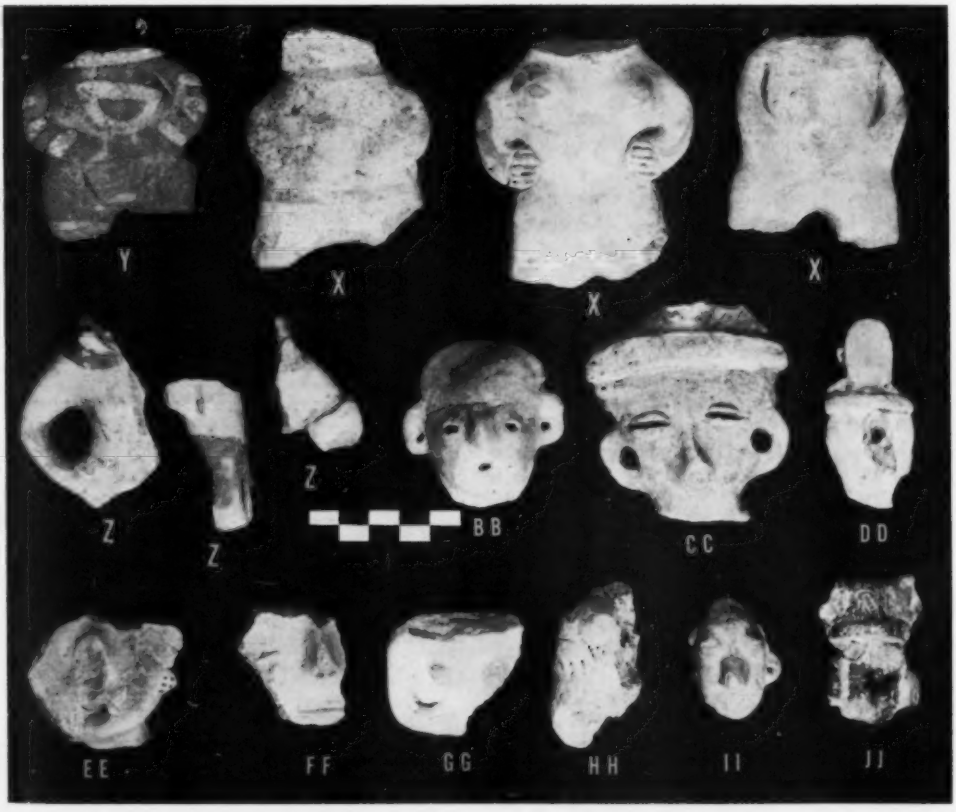

FIG. 6. Amapa figurines, Types X–Z, BB–JJ. Scale is 5 cm. long.

are considered to date from the early part of the Early Period.

Type W. Five specimens of this type occur in the four stratigraphic pits. Four of these are in the lower half of the Early deposits. The fourth specimen is from early Late deposits. The latter specimen is believed to be out of place and the type is considered to date from the early portion of the Early Period.

Type X. Twenty-seven specimens of this type were found in the four stratigraphic pits. All are from the Early deposits and, therefore, are assigned to the Early Period.

Type Y. The one Type Y specimen is from the 4.20 to 4.40 m. level of Pit B–14 and is the deepest figurine from that pit. An early Early Period date is suggested.

Type Z. Three specimens of this type were found in Pit B–15 at depths ranging from 3.20 to 4.00 m., and one was found in the 4.00-to-4.20-m. level in Pit B–13. They probably date from the late Early Period.

Type AA. Twenty-two examples of this type came from the four stratigraphic pits. They occur in the lower half of the Early deposits and, hence, are thought to date from the early Early Period.

Feet. Solid, cusp-footed legs occur throughout the Early deposits, and are therefore assigned to the Early Period.

The chart in Figure 7 summarizes these chronological suggestions.

Speculations

A glance at the chart (Fig. 7) shows an abrupt break between the Early and Late periods. The subdivisions within these Periods may be oversimplified, but the sharp cleavage between the two main Periods is undoubtedly real. The division is particularly clear in Pit B–15, where the latest Early level contained only 14 sherds. In other words, in B–15 there is evidence for a brief period when the mound was not occupied. In B–14, which was dug into the same mound as B–15, the gap is not as evident, but there is still a sharp cultural break. The critical zone change in Pits B–11 and B–13 appears, on casual inspection, to be a mixture of Early and Late ceramics.

Further evidence of the break between the two periods may be obtained by examining the ceramics. There are no transitional types, that is, no Early type may be seen as directly ancestral to any Late type. In addition it should be noted that copper objects, chile grinders (molcajetes) and distinctive spindle whorls also appear with the Late Period ceramics. The interpretation that the Late Period marks the invasion of the area by a new people seems inescapable. Whether or not a temporal gap exists between the disappearance of the Early Period people and the appearance of the Late Period people remains to be demonstrated. The apparent gap in the B–15 deposits may just record the abandonment of that particular mound and not the abandonment of the site or the area.

The subdivisions within the Early Period receive some support from the ceramics found in Pit B–15. Amapa Red-on-Buff pottery occurs throughout the Early deposits. In the middle of these deposits Gavilán Polychrome (Early Chametla Polychrome) has its greatest frequency. In the levels above the Gavilán Polychrome, Amapa White pottery has its greatest frequency. It appears that the white-slipped figurines (Types O and P and White-filleted) are to be associated with the Amapa White pottery. It should be noted that the White-filleted figurines are typical of Middle Chametla at Chametla. Middle Chametla polychrome ceramics appear to be absent at Amapa. There are only a few Amapa White sherds at Chametla. Kelly (1938: 17) believes that Middle

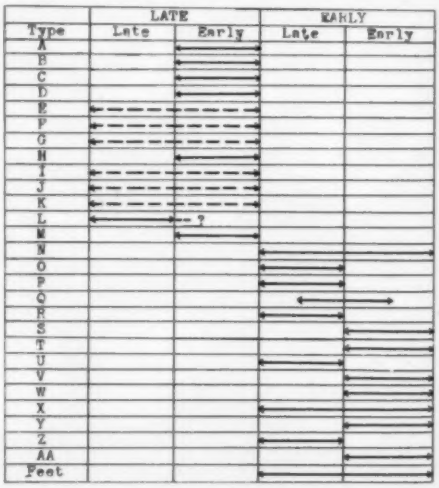

Fig. 7. Relative chronological position of Amapa figurines.

Chametla Polychrome does not derive from Early Chametla Polychrome. The contemporaneity of occupation at Chametla and Amapa is demonstrated by the occurrence of the figurines. The ceramics suggest that we are dealing with two separate ceramic traditions. If the figurines represent religious paraphernalia, it may be suggested that Amapa was a religious center during Middle Chametla times, but several assumptions are involved here which must be demonstrated before such an idea can be accepted.

With the appearance of the Late Period peoples, figurine resemblances shift to the south and east and probably indicate the direction from which these people came. Despite the fact that Mazapan figurines were defined originally on the basis of their Valley of Mexico occurrences, there is no proof that this type of figurine originated there. Ekholm (1942: 125–32) has suggested a Mixteca-Puebla invasion at Guasave after Middle Chametla times. Analysis of the Amapa Late Period ceramics will undoubtedly throw much light on this and other related problems. The figurines by themselves are inadequate to answer the question.

Trade relations can best be shown by an analysis of the sherds, but it seems possible that the Type O and P figurines were traded to Chametla. The possibility remains that both Chametla and Amapa got them from some intermediate source. The Type M figurine probably is a trade piece too, but its source is not known. The paste resembles that of the Early uniface and biface polychrome from the Ixtlán del Río area to the south.

It is probably premature to speak of absolute dates for the figurine types; however, if Lister's date (1955: 51) for Mazapan figurines of from A.D. 900 to 1200 is correct, it would certainly be safe to date the beginning of the Late Period at A.D. 1000 ± 100 years. If the Spinden correlation is accepted with its earlier dates (Jennings 1956: 94), then a beginning date of around A.D. 800 would be a conservative date for the Late Period. Certainly the Early Period at Amapa is contemporaneous with at least a part of the Classic Period in Central Mexico.

In their recent revision of the Sinaloa sequence, Kelley and Winters (1960: 560, Fig. 8) suggest a beginning date for the Tierra del Padre phase (Early Chametla) of A.D. 250–300. The deposits at Amapa are at least as ancient as those of Chametla. The Amapa sequence is in agreement with the early part of the revised sequence (the part not requiring revision). Although we agree to the need for revising the Aztatlán complex, our analysis of the late Amapa ceramics is not far enough along to test the revision presented by Kelley and Winters.

Acknowledgments. There are many people who contributed materially to the success of the Amapa excavations. The Mexican government and its representatives cooperated fully. Monetary support, without which the excavations would never have started, came from the following persons: Mr. and Mrs. P. Berg, Mr. and Mrs. V. J. Bergeron, Mr. and Mrs. W. Collier, Mr. and Mrs. J. Dart, Dr. and Mrs. R. E. Fuller, Mr. and Mrs. A. T. Gilman, Herman Guttman, and Stanley Slotkin (in addition to research funds from the University of California, Los Angeles). Finally, we wish to express our appreciation to the many people of Santiago Ixcuintla, Amapa, Gavilán, Peñitas, and Sentispac. They not only did most of the hard work, but welcomed us into their homes. We treasure them now as friends.

ARMILLAS, PEDRO
1948 Arqueología del Occidente de Guerrero. *El Occidente de México. Cuarta Reunión de Mesa Redonda sobre Problemas Antropológicos de México y Centro America.* Mexico.

EKHOLM, G. F.
1942 Excavations at Guasave, Sinaloa, Mexico. *American Museum of Natural History, Anthropological Papers,* Vol. 38, Part 2, pp. 23–139. New York.
1948 Ceramic Stratigraphy at Acapulco, Guerrero. *El Occidente de México. Cuarta Reunión de Mesa Redonda sobre Problemas Anthropológicos de México y Centro America.* Mexico.

FAY, G. E.
1959 Handbook of Pottery Types of Nayarit, Mexico. *Instituto Interamericano, Miscellaneous Papers, Archaeological Series* No. 1. Magnolia.

GIFFORD, E. W.
1950 Surface Archaeology of Ixtlán del Rió, Nayarit. *University of California Publications in American Archaeology and Ethnology,* Vol. 43, No. 2. Berkeley.

JENNINGS, J. D. (EDITOR)
1956 The American Southwest: A Problem in Cultural Isolation. In "Seminars in Archaeology: 1955," edited by Robert Wauchope, pp. 59–127. *Memoirs of the Society for American Archaeology,* No. 11. Salt Lake City.

KELLEY, J. C. AND H. D. WINTERS
1960 A Revision of the Archaeological Sequence in Sinaloa, Mexico. *American Antiquity,* Vol. 25, No. 4, pp. 547–61. Salt Lake City.

KELLY, I. T.
1938 Excavations at Chametla, Sinaloa. *Ibero-Americana,* 14. University of California Press, Berkeley.

1945a Excavations at Culiacán, Sinaloa. *Ibero-Americana*, 25. University of California Press, Berkeley.

1945b The Archaeology of the Autlán-Tuxcacuesco Area of Jalisco. I: The Autlán Zone. *Ibero-Americana*, 26. University of California Press, Berkeley.

1947 Excavations at Apatzingan, Michoacan. *Viking Fund Publications in Anthropology*, No. 7. Wenner-Gren Foundation for Anthropological Research, New York.

1949 The Archaeology of the Autlán-Tuxcacuesco Area of Jalisco. II: The Tuxcacuesco-Zapotitlán Zone. *Ibero-Americana*, 27. University of California Press, Berkeley.

Linné, Sigvald

1934 Archaeological Researches at Teotihuacan, Mexico. Ethnographical Museum of Sweden, n.s., *Publication* No. 1. Stockholm.

Lister, R. H.

1949 Excavations at Cojumatlán, Michoacán, Mexico. *University of New Mexico, Publications in Anthropology*, No. 5. Albuquerque.

1955 The Present Status of the Archaeology of Western Mexico: A Distributional Study. *University of Colorado Studies, Series in Anthropology* No. 5. Boulder.

Lister, R. H. and A. M. Howard

1955 The Chalchihuites Culture of Northwestern Mexico. *American Antiquity*, Vol. 21, No. 2, pp. 122–9. Salt Lake City.

Meighan, C. W.

1959 New Findings in West Mexican Archaeology. *Kiva*, Vol. 25, No. 1, pp. 1–7. Tucson.

1960 Prehistoric Copper Objects from Western Mexico. *Science*, Vol. 131, No. 3412, p. 1534. Washington.

Muller, E. F. Jacobs

1955 Una Efigie Femenina de madera de Cualac, Guerrero. *El Mexico Antiguo*, Vol. 8, pp. 135–40. Mexico.

Noguera, Eduardo

1954 *La Cerámica Arqueológica de Cholula*. Editorial Guarania, Mexico.

Retes, Miguel

1845 Apuntes de un viage: Santiago Ixcuintla. *El Museo Mexicano*, segunda época, Vol. 1, pp. 1–6. Mexico.

Sauer, Carl and Donald Brand

1932 Aztatlan, Prehistoric Mexican Frontier on the Pacific Coast. *Ibero-Americana*, 1. University of California Press, Berkeley.

Vaillant, G. C.

1938 A Correlation of Archaeological and Historical Sequences in the Valley of Mexico. *American Anthropologist*, Vol. 40, No. 4, pp. 535–73. Menasha.

1941 *Aztecs of Mexico*. Doubleday, Doran, Garden City.

Weitlaner, R. J.

1948 Exploración Arqueológica en Guerrero. *El Occidente de México. Cuarta Reunión de Mesa Redonda sobre Problemas Antropológicos de México y Centro America*. Mexico.

University of Utah
Salt Lake City, Utah
August, 1960

Photo by Odd Halseth, at the 1948 Pecos Conference, University of Arizona Archaeological Field School, Point of Pines, Arizona, August, 1948.

CLYDE KAY MABEN KLUCKHOHN
1905–1960

With Kluckhohn's death at Santa Fe on July 29, 1960, American Archaeology lost a long-time friend and sympathetic but merciless critic. His continued archaeological interest is reflected in his membership in the Society for American Archaeology from the year of its founding. Archaeologically, his classical interests first inclined him toward the Old World, but when he left Princeton in 1923 because of poor health and spent a summer in the Southwest he developed a keen enthusiasm for both the past and present of the "Indian Country" that continued for the rest of his life. This first vivid Southwestern experience is described in *To the Foot of the Rainbow* (1927, Century, New York; 1928, Nash and Grayson, London) — a trip by horseback from Ramah to the Rio Grande pueblos and Santa Fe, over the Jemez Plateau and north to the Mesa Verde, to Canyon de Chelly, Kayenta, and finally Rainbow Bridge. Subsequent pack trips (1926, 1927, and 1928) culminated in the archaeological exploration of the remote and rugged country north of Navajo Mountain, especially Wild Horse Mesa. In *Beyond the Rainbow* (1933, Christopher, Boston) these adventures are told in the same informative style as in the earlier volume, but with a conspicuous addition, a chapter on "The First Americans" (pp. 210–31) summarizing the peopling of the New World, Basketmaker-Pueblo culture history, the technique of tree-ring dating, the Maya calendar, and theories of trans-Atlantic and trans-Pacific

(continued next page)

influence on the New World; also, the archaeology of Wild Horse Mesa is sketched, on the basis of considerable serious reconnaissance work. Although Kluckhohn's written contributions to archaeology remained few, he continued from the early 1930's onward to keep abreast of archaeological thought and field work, and was always emphatic in his insistence on the essential continuity of the archaeological past with the ethnographic present, and on the importance of archaeological findings being interpreted in the light of the entire spectrum of anthropological specialties.

From 1932 to 1934 he was assistant professor of anthropology at the University of New Mexico, and at the same time research associate in archaeology of the School of American Research. Although his interests in the Navajo, in Indian languages, in social anthropology, and in anthropological theory were already strong, his archaeological interests continued, and he participated in the summer field school programs in Chaco Canyon and Jemez Canyon (1932–34, 1937). The culmination of this activity was the 1939 volume edited jointly with Paul Reiter, "Preliminary Report on the 1937 Excavations of Bc50–51, Chaco Canyon, New Mexico, with some Distributional Analyses" (*Univ. New Mex. Bull., Anth. Ser.*, Vol. 3, No. 2). In addition to his share of the editing, he wrote about one fourth of the text, his most important contribution being the final "Discussion" (pp. 151–62). This chapter is still a valuable critique of the Pecos Classification, and on its publication stimulated many archaeologists to examine more carefully the bases on which their chronological schemes were built. Kluckhohn wrote, for example:

> Probably the single fact of greatest general import which has emerged thus far from the Bc50–51 excavations is that the various stages recognized by the Pecos classification (and very commonly referred to as "periods") do not, necessarily, represent clear-cut time periods, *even in the same geographical locality*. (p. 159)

He pointed out that neighboring villages, classified as Developmental and Great Pueblo (in Roberts' terminology) were occupied contemporaneously, their architectural or ceramic differences indicating that cultural changes occur with much less regularity than has often been assumed. His closing statement is still pertinent to the continuing problem of archaeological taxonomy:

> Surely, all classifications can but, at best, express modal tendencies and must be used purely heuristically, with constant awareness that they are most crude categorizations of the human acts we are trying to reconstruct. (p. 162)

In 1935 Kluckhohn joined the Department of Anthropology at Harvard, where he remained until his death, also associated with the Peabody Museum of American Archaeology and Ethnology and with the Department of Social Relations. He had published, in 1935, one short article in the Maya field, "A Note on the Sources of the Drawings in the Del Rio Volume on Palenque" (*Maya Research*, Vol. 2, pp. 287–90), and was invited to contribute to the volume of papers being prepared for A. M. Tozzer. The volume appeared in 1940, titled *The Maya and Their Neighbors* (edited by C. L. Hay and others; D. Appleton-Century, New York), and many of Tozzer's friends and admirers were shocked that "The Conceptual Structure in Middle American Studies" (pp. 41–51) contained a number of fairly blunt criticisms of the lack of methodological rigor and explicit purpose of Maya scholars, and of archaeologists in general. Kluckhohn said, for example:

> . . . I should like to record an overwhelming impression that many students in this field are but slightly reformed antiquarians. To one who is a layman in these highly specialized realms there seems a great deal of obsessive wallowing in detail of and for itself. (p. 42)

And from a broader point of view he asked:

> Do researches which require large funds for their support require no social justification other than that of quenching certain thirsts for knowledge on the part of a relatively small number of citizens? (p. 43)

All of this essay is still well worth a careful reading. It was received by some as an unnecessarily sharp attack on the work of the large circle of eminent Maya scholars among whom Tozzer was numbered. We should recall that Tozzer's translation of Landa's *Relación* was published in 1941, with its 1154 footnotes (some of them one and two pages in length), its 91-page "syllabus," its concordance of earlier editions, and so on. Kluckhohn's criticisms were not, however, directed specifically at Tozzer, whom he liked and respected, but at archaeology in general, and his strictures were supplemented by clear statements of what approaches would, in his opinion "suggest the pertinence of various constellations of data to the primary problems of human interaction."

It should perhaps be mentioned that W. W. Taylor's dissertation, presented at Harvard in 1943 (published in 1948 as "A Study of Archeology," *Am. Anth. Assoc. Mem.* 69) was written

partly under Kluckhohn's supervision, and carries some of the same criticisms and suggestions considerably further than was ever done by Kluckhohn.

Although Kluckhohn reviewed archaeological publications from time to time (three books by Hewett and Eric Thompson's *The High Priest's Grave* in 1939 [*Bol. Bibl. Antro. Am.*, Vol. 3, pp. 50–1], Volumes 1 and 2 of the *Handbook of South American Indians* in 1946 [*Science*, Vol. 104, pp. 212–3], *Men out of Asia* by H. S. Gladwin in 1947 [*N. Y. Herald Trib. Bk. Rev.*, Dec. 14, p. 10], C. S. Coon's *The Seven Caves* in 1957 [*Sat. Rev.*, Jan. 5, p. 11]) and wrote an obituary of Paul Reiter in 1954 (*Am. Anth.*, Vol. 56, pp. 1085–7) and one of Tozzer in 1956 (*Am. Philos. Soc. Year Bk.*, pp. 128–31), his only other specifically archaeological writing was the chapter "Potsherds" (pp. 45–77) in his tremendously popular *Mirror for Man* (1949, Whittlesey House, New York). In this he goes considerably beyond a discussion of what archaeology is, to discuss the importance of the historical approach for an understanding of man in all his aspects.

His professional interests ranged widely through social anthropology, psychiatry, art, religion, and language, to name a few of the fields he worked intensively in, but his concern for archaeology continued and in recent years his interest in the significance of what is conveniently called "material culture" for insights into many facets of man's behavior assumed steadily greater proportions. He was Curator of Southwestern American Ethnology at the Peabody Museum, and at his death was collaborating with W. W. Hill on a comprehensive study of Navajo material culture, the only aspect of the Navajo, as he once said, in which pioneering work remained to be done. He was also deeply involved in the archaeological research carried on by the Navajo tribe in support of its land claims, a major research program on a long-neglected part of Southwestern archaeology.

In sum, the very range and variety of Clyde Kluckhohn's interests and the number of his professional commitments resulted in his contributions to some of the fields of social science falling short of what his desires and abilities might have achieved if channelled into a single specialty. Yet although he devoted the greater part of his career to non-archaeological pursuits, the study of the past, and especially the prehistory of the Southwest, held a continuing fascination for him. His archaeological writings are marked by valuable insights, by rigorous criticisms, and by urgent pleas for greater methodological precision and for greater breadth and depth of interpretation that make them provocative and significant contributions to the basic literature of archaeology.

RICHARD B. WOODBURY

ULTRASONIC CLEANING OF ARTIFACTS: A PRELIMINARY CONSIDERATION

R. F. G. Spier

Abstract

Ultrasonic cleaning, a technique of wide industrial application, is suggested as applicable to archaeological artifacts. Speed and superior cleanliness ought to be its principal merits. A review of various ultrasonic methods and some pilot tests reveal an incapacity to handle large quantities of dirt. Preliminary cleaning may solve this problem. Two direct mechanical methods of ultrasonic cleaning are proposed as they offer simplicity, ruggedness, economy, and field adaptability.

ULTRASONIC CLEANING has recently become widespread in industrial applications due to its thoroughness, its speed, and its ability to clean all surfaces of complex shapes. These merits may also recommend it to the archaeologist faced with the cleaning of thousands of artifacts. The discussion of this possibility will be divided into three main sections: (1) the nature of ultrasonic cleaning and its present state of development; (2) some preliminary experiments conducted on artifactual remains; and (3) the conclusions drawn from experimentation and suggestions for further exploration of this technique.

Ultrasonics and Ultrasonic Cleaning

The generic term "ultrasonics" refers to sound waves vibrating at a frequency (or pitch) above the upper limit of human hearing; roughly this may be taken to include sounds having frequencies in excess of 15,000 cycles per second (15 kc/sec). Sound waves at these high frequencies possess numerous interesting and valuable properties, some of which have been effectively exploited over the past two decades. On this base rests the development of such diverse applications as: sonic thickness gauges, flaw and strain detectors, Sonar, sonic emulsification, flux-free soldering of chemically active metals, ultrasonic drilling of odd-shaped holes or hard materials, and ultrasonic cleaning. We are, of course, concerned with the last of these.

Ultrasonic waves may be propagated by numerous means in a wide variety of media. The means of propagation and the manner of coupling the sound source to the medium must be appropriate to the circumstances and the results sought. For our purposes we may consider these approaches as divided into four groups: (1) those relying on piezo-electric effects; (2) those relying on magneto-electric effects; (3) those involving magneto-strictive effects; and (4) those involving simple mechanical effects.

The piezo-electric effect has been known for some years, but recent technical developments have greatly enhanced its industrial utility. Piezo-electric materials (quartz, tourmaline, Rochelle salt, and related natural crystals) possess three related properties. They will resonate electrically at a frequency determined by their physical size, thereby furnishing a stable frequency control for electronic oscillating circuits. They will produce electricity when subjected to mechanical pressure, as in certain strain gauges or in the more familiar crystal phonograph pickup cartridge. Lastly, they will move mechanically in response to applied electrical impulses. This last property was early utilized in the ultrasonic field, with the crystalline material excited to mechanical movement by impulses from a high-frequency electronic oscillator comparable to a radio transmitter. (Despite the closeness to the audio range of the frequencies produced, for certain technical reasons it is more efficient to treat them as though they were common radio frequencies.) However, the character of these naturally-occurring crystalline materials placed certain restrictions on their use. They are limited in physical size and limited in their capacity to handle large amounts of power. If over-excited, the mechanical movement becomes so great as to fracture the crystal. With the development of barium titanate, a piezo-electric ceramic, some of these obstacles were cleared away. Comparatively, the size of the radiating surface became limitless because the cheaper and larger ceramic discs could be used in multiples. Though the power-handling capacity per unit of surface area was not greatly increased, the gross power capacity was. The relative ease of forming the ceramic, while still in a plastic state, made focusing of the waves readily possible. Barium titanate transducers, which convert the electrical energy originating in a high-frequency oscillator or generator into mechanical motion coupled to the treated material, are now commonly used in all small- and medium-sized ultrasonic cleaning apparatus. In the focused form, they are also used to produce tremendous sonic intensities in the treatment area in some chemical processing equipment

The characteristics of several piezo-electric materials may be summarized as follows: quartz crystals will operate from 100 to 10,000 kc/sec, with low power outputs into solids and gases, but higher powers into liquids, generally efficient; Rochelle salt will operate from 0.2 to 1000 kc/sec, into solids and liquids (under special conditions), with strong effect but low stability; barium titanate will operate from under 100 to 10,000 kc/sec, into liquids at high powers when beamed or focused.

The magneto-electric effect is to be observed in devices bearing a general similarity to the common loudspeaker. In one type a coil, when excited with a current, moves in a fixed magnetic field. In another the magnetic field varies and causes, through induction, movement of normally non-magnetic materials within the field. The power source for either type may be an oscillator-amplifier (of the radio transmitter type) comparable to that used with piezo-electric transducers or else a rotary converter producing a high-frequency alternating current.

The operating capacities of magneto-electric transducers may be summarized as follows: the moving coil type operates from 0.2 to 25 kc/sec, with good transmission into gases and solids, especially the latter; the moving solid type operates from 0.2 to 5 kc/sec, with transmission into gases, liquids, and solids, especially good into solids, but with problems of coupling the transducer to its load.

Magneto-striction has been successfully applied in recent ultrasonics. This effect relies on the change of length which occurs in certain materials, notably nickel alloys, when they are placed in a magnetic field. While the movement is always very small, it may be intensified if the magnetic field fluctuates in resonance with the natural resonant frequency of the metal within the field. Excitation of the magnet is provided, as in the preceding two varieties of ultrasonic transducers, by a radio-oscillator and amplifier. Coupling of the transducer to its load may be direct, as to liquid and solid loads, or indirect, as to liquid and gaseous loads, through a diaphragm.

The operating characteristics of magneto-strictive transducers may be summarized as follows: frequency may range from 10 to 100 kc/sec; power capabilities are low into gaseous and solid loads, but high into liquid loads; efficiency is low, but stability is great.

The mechanical means of producing ultrasonic waves are numerous, for any device capable of making a continuous sound in air also has ultrasonic possibilities. Here may be included tuning forks, motor-driven diaphragms and pistons, sirens, resonant cavities (such as the Galton whistle), and resonant wedges (such as the Pohlman whistle). Some of these are of purely academic interest, lacking power capabilities at the industrial level. Of the others, two have potentialities for ultrasonic cleaning.

The siren has been well developed as an ultrasonic source coupled to a gaseous load. Its use requires two power sources, one to rotate the siren proper, the other to produce a moving gas stream which the rotor may interrupt. Low-powered installations, operating in the sonic range, use the rotor itself as a centrifugal blower to produce the gas stream; this is the case with the familiar siren used on emergency vehicles. The siren may operate into a liquid load, but coupling to a solid load is virtually impossible.

The Pohlman whistle (a resonant wedge) uses a resonating wedge which splits a liquid stream issuing from an orifice. Movement of the stream causes the wedge to flex, first in one direction then in the other. By suspending the wedge at its nodal points so that it is free to vibrate at its natural frequency and by tuning the assembly as a whole, powerful resonance may be produced. Since this resonance occurs in the liquid being treated there is no problem of coupling between transducer and load. A single power source, a pump to provide the moving liquid stream, is required.

The operating characteristics of the several mechanical means may be summarized as follows: the tuning forks operate from 0.2 to 90 kc/sec, with extremely low powers; motor-driven systems operate at lower frequencies only, with higher power outputs; sirens operate from 0.2 to 250 kc/sec, at high powers, but with poor transfer efficiency into the load; the resonant cavities operate from 2 to 100 kc/sec, at low powers, with good transfer efficiency; and the resonant wedges operate from 2 to 50 kc/sec, with good transfer efficiency.

The foregoing is a grossly simplified account of the several approaches to production of ultrasonic waves. Since the means are best coordinated with the ends, categorical statements about their relative merits are inherently suspect. An attempt has been made to keep the discussion and evaluation in line with our principal interest, ultrasonic cleaning.

The ultrasonics field is characterized by active research and development by numerous participating groups, both academic and industrial. The resulting new designs and new materials have opened new vistas of application and overcome the obstacles to exploitation of hitherto developed approaches. For these reasons, if for no other, we cannot consider this summary as exhaustive or definitive. It is intended as purely suggestive.

While the precise nature of ultrasonic cleaning is still under investigation, certain aspects of the phenomenon are moderately well known. One force leading to the removal of soil particles is the scouring action resulting from the movement of a liquid in wave motion. This rapid change of direction of movement can result in tremendous accelerations, far beyond those commonly observed in mechanical systems. According to one interpretation, when these accelerations exceed the ability of the liquid to follow the directional changes, cavitation is produced. There is general agreement that the cleaning action is speeded in the presence of cavitation. The erosion of materials, especially hard, porous ones, by cavitation gives testimony to the forces developed under this condition. The cleaning action may then be due to the combination of high velocity liquid motion and the erosive action of cavitation. The bursts of cavitation, comparable to the bubbles in boiling liquids, will be present at the surfaces of solid materials in the sound path, and most intense at edges, points, and crevices in this material. The high hydrostatic pressures produced at these bubbles, possibly of the order of several thousand atmospheres, may literally explode away adhering particles. In fibrous materials cavitation is evidently not as effective a cleaning force as is the liquid motion. Due to the resilience of the fibers there is very little erosion or surface breakup.

For most applications in which the archaeologists would be interested, the production of cavitation is probably desirable. If this is the case, some of the operating conditions are defined for us.

First of all, cavitation is inhibited by the presence of dissolved gases in the cleaning liquid. This gas is usually driven off by the action of ultrasonic waves within minutes after the beginning of treatment, full cleaning action cannot be expected until degassing is complete. A delay on this score may be anticipated unless a large supply of degassed, or stagnant, water is at hand.

Table 1. Summary of Ultrasonic Cleaning Tests

Batch	Machine	Time	Sample	Cleanness Ranking	Comments of cooperating field archaeologist
1	Cavitator	8'00"	flint, rough sherds, animal bone, seeds	2	"the cleanest of the artifacts for study; all readily usable in any analysis"
2	Cavitator	5'00"	stone, brick, concrete, glass, china, wood	1	"cleanest; due perhaps to the material cleaned-"
3	Cavitator	2'00"	flint, animal bone; one rough sherd	4	"easy to study, but requiring further cleaning before cataloging, etc."
4	Narda	3'30"	flint, sandstone, animal bone, rough sherds	4-5	no comment
4B	Narda	8'00"	as above, continuation of run with half of sample	3	"not bad, but require some further polishing before numbering, or especially, photo work"
			cord-roughened sherds only from sample 4B	4-5	"I like potsherds that are, cleaner than these ... again, perhaps more cleaning would remove paint or slip"
5	Narda	8'30"	whole human cranium embedded in silty loam		cranium initially cracked; face disintegrated into small fragments immediately; only moderately clean

Notes: Cavitator filled with water and liquid detergent; Narda with plain water. All samples are rinsed under sink spray after removal from tank; air-dried on cloth.

Secondly, the choice of frequencies and powers of operation will be dictated by the necessity of producing cavitation. While the production of cavitation depends on the characteristics of the entire system (the vibrator face, the liquid, dissolved gases, etc.) it is not likely to occur at low intensity levels much below one watt per square centimeter of surface in the sound path. Likewise cavitation is unlikely to occur at very high frequencies, those much over 1000 kc/sec. The relationship between sound intensity and frequency is such that cavitation will occur at higher frequencies at higher sound intensities, but in general frequency seems less critical than power. We may therefore expect results at powers between one and ten watts per square centimeter and at frequencies between 15 and 100 kilocycles per second.

Some Preliminary Tests

The possibilities of ultrasonic cleaning for rapid and thorough treatment of artifactual remains led me to carry out some small-scale tests. Equipment used in these tests was chosen solely on the basis of availability and did not represent the optimal choice.

The first apparatus used was an experimental device designed to study luminescence in liquids under cavitation. It operated at 800 kc/sec with an input power of 300 watts to the oscillator-amplifier. The treatment chamber, of glass, had a capacity of approximately 100 ml. and was coupled to a quartz crystal transducer which produced a sound intensity of about 10 watts per square centimeter in the sample. Intense cavitation could be produced in the treated liquid.

The second apparatus used was a small commercially-made ultrasonic cleaner (Cavitator Mk V, Mettler Electronics Corp.) operating at 40 kc/sec with a gross power consumption of 550 watts. The estimated sonic power applied to the 5-gallon treatment tank was not in excess of 100 watts, probably closer to 50 watts. The transducer is believed to be a piezo-electric ceramic.

The third apparatus used was another small commercially-made ultrasonic cleaner (Narda NT-1505A) operating at 40 kc/sec with a nominal power of 200 watts input to the 5-gallon treatment tank. The transducer is ceramic, barium titanate.

The test materials were derived from a variety of local sources. Included were surface-collected materials from a site in eastern Missouri, excavated materials from another eastern Missouri site, a whole human cranium excavated from a third site, and a miscellany of surface items (not strictly archaeological artifacts) collected from a campus construction area.

The few initial tests made with the 800 kc/sec experimental apparatus were so inconclusive, due to the small sample size, that they have been disregarded. The tests with the larger commercial machines are summarized in Table 1. Rather clearly the smoother materials were better cleaned, while rough pottery and bone remained soiled. Despite the lesser probable power of the Cavitator it produced better results. While in one instance these results may be due to the nature of the sample, in general it may be attributable to the added detergent. Unfortunately, the use of clear water and water with added detergent was not possible in both machines. The use of a detergent should certainly aid the process in any machine and is standard, where otherwise tolerable, in industrial applications.

The test involving the whole cranium, earth embedded, was purely speculative. The results, in terms of material usable for study, were disastrous. The pieces into which the skull broke were much smaller than those which might have resulted from the most amateurish dry cleaning. Possibly the disintegration would have occurred, ultrasonic action or not, following eight to nine minutes of water soaking. Material of this type being in short supply it was not possible to experiment further in this vein.

Since all apparatus used in these tests was borrowed and used in premises occupied by other, on-going activities, the tests were perforce limited. There was nowhere at hand an ultrasonic cleaner offering the range of frequencies and powers needed for a thorough investigation of this technique. Such a device, incidentally, would have to be specially designed and constructed for such a study because of the matching necessary between the components in any ultrasonic system.

Conclusions and Suggestions

In the circumstances tested ultrasonic cleaning of archaeological artifacts is not deemed profitable. It neither resulted in greater cleanliness nor in greater speed of cleaning; both of these attributes were the anticipated advantages of the method. Nonetheless, since the tests were quite abbreviated and did not permit familiarization with the equipment or possible variations in its use, it would be unwise to summarily dismiss a technique of proven merit in other applications. We may, therefore, profitably consider some suggestions for further exploration and possible application of this cleaning method.

As they are presently designed, small ultrasonic cleaning units of commercial manufacture are not well suited to handling the large quantities of dirt which may adhere to archaeological artifacts. The transducer of most models is set into the bottom of the tank and its effectiveness may be quickly reduced by the accumulation of mud on the bottom.

Further, most tanks have a comparatively small drain plug (about ¼ to ⅜ inch in diameter) set into the lower border of one wall; emptying the tank through such a drain is a slow process, sometimes impeded by the presence of mud. However, the tanks of some units (for example, the Narda tested) are separate from the high-frequency generator. As long as the tank weight is not great, it might be possible to lift the tank, after removing the artifact basket, and pour its contents, mud and all, into a sink or drain. Preliminary washing of the artifacts would also speed the general process by reducing the burden of dirt.

Cavitation proceeds best in degassed liquids. Fresh water introduced into the cleaning tank with each load, or introduced by a continuous-flow scavenging system, would have to be degassed before maximal cleaning efficiency is reached. With the application of substantial sonic power, it may prove that this difficulty is more hypothetical than real.

Turning from conventional equipment, we might well consider the potentialities of two devices not ordinarily employed in cleaning applications. If they prove feasible, a matter yet to be determined, they will have considerable merit for field use. Both are simple, durable, and have limited power supply demands. By contrast, it might be noted, the piezo-electric cleaners require electric power at standard voltages (110–120 volts), are not especially resistant to mechanical shock, and may be susceptible to moisture damage.

The siren, long a familiar sound source in gaseous media, may have its applications to ultrasonic cleaning. The sonic source of a siren may hang free of the tank walls and bottom; no settlement of soil would attenuate its power. The rotor of the siren can create its own liquid flow, through centrifugal action, or may interrupt a stream flow introduced from outside the tank. In the latter case the through-flow may also provide scavenging action to clear the tank of accumulating dirt. The siren rotor shaft may be driven directly, or through appropriate V-belts, by a small gasoline engine. Conceivably the entire apparatus (engine, siren, drive-shafts, and any associated pumps) could be designed as a single, self-contained unit and so be transferable, much like a marine outboard motor, from one cleaning tank to another.

Criticisms of the siren as a sonic device hinge on two points: (1) its unstable frequency; (2) its inefficiency of power transfer into the load. In a cleaning application, frequency can probably range over a broad spectrum without harm. The engine governor is capable of keeping the siren rotor close enough to the desired speed. (Frequency will vary directly with the speed of the rotor.) On the second point, the cost of applied power (per watt or horsepower) is very low, when in the form of a small gasoline engine, compared to its cost in the form of a high-frequency oscillator. Under these circumstances, low efficiency of power transfer is tolerable, for large amounts of cheap power are available. Finally, the siren as a general device is characterized by its high power capabilities with the possibility of transmitting over a hundred horsepower to a single unit, far more than may be put into most other ultrasonic transducers.

The Pohlman whistle, or resonant wedge, offers another direct transfer approach, characterized by elegant simplicity. The whistle itself consists of a resonating metal wedge centered in a liquid stream flowing from an orifice. The wedge, whose design is such that its natural resonant frequency is the desired one, is held at its nodal points so as to avoid damping of its vibrations. The distance between orifice and wedge is critical and is adjustable to tune the whistle. The whole assembly is submerged in the treated liquid. While this whistle was originally designed for emulsification of liquids, a process assisted by ultrasonic action, it is possible to produce cleaning action. The whistle is capable of producing powerful cavitation, at least in its immediate vicinity.

The power source for the Pohlman whistle is a moving liquid stream at high pressure which may be supplied, in field usage, by an engine-driven pump. Agricultural spraying pumps, of simple design and compact construction, are capable of supplying the necessary pressure and quantity (between 150 and 250 pounds per square inch and 5 to 10 gallons per minute) with a motive force of about 5 horsepower. The entire apparatus would consist of the pump and the whistle; the latter may readily be moved from one treatment tank to another.

Since the metal wedge will be rapidly eroded by dirt particles in the high-pressure stream, it is necessary to introduce a filter into the water supply circuit. If clear water is available in quantity, the filtration need not be elaborate. If it is desired to recirculate the cleaning solution, then more elaborate filtration will be necessary. Settling basins might be incorporated into the complete circuit if total water economy is sought.

I am inclined to favor, as subject for further investigation, the direct mechanical approach to propagation of ultrasonic waves in a liquid medium. Though as yet untested and unproved in archaeological cleaning applications, the siren and the resonant wedge show promise of fulfilling the specifications of cost, simplicity, portability, reliability, and repairability. The field archaeologist,

through their use, may be able to clean, with small expenditure of labor and time, artifacts as fast as they are excavated.

Despite the inconclusive results of these admittedly inadequate tests, it is still felt that for certain types of archaeological application the ultrasonic cleaning technique warrants consideration. Perhaps some interest in this new potential tool can be engaged.

Acknowledgments. I wish to acknowledge the assistance of members of the Department of Physics and of the School of Medicine at the University of Missouri, as well as my indebtedness to my anthropological colleagues, especially Richard O. Keslin (now of Beloit College) and Dale R. Henning. Numerous others have given consultation on various phases of the investigation.

Alexander, P.
1951 Emulsification with Sound Waves. *Manufacturing Chemist*, Vol. 22, pp. 5–8, 12. London.

Crawford, A. E.
1955 *Ultrasonic Engineering, with Particular Reference to High Power Applications.* Butterworth, London.

Janovsky, W. and R. Pohlman
1948 Schall- und Ultraschallerzeugung in Flüssigkeiten für industrielle Zwecke. *Zeitschrift für angewandte Physik*, Vol. 1, pp. 222–8. Berlin.

Van Antwerpen, F. J. (editor)
1951 Ultrasonics: Two Symposia. *Chemical Engineering Progress Symposium Series*, No. 1, Vol. 47. American Institute of Chemical Engineers, New York.

University of Missouri
Columbia, Mo.
May, 1960

FRESH-WATER ARCHAEOLOGY *

Donald P. Jewell

Abstract

Because fresh-water dams are flooding areas faster than archaeologists can investigate them, it has become urgent to develop a method of underwater archaeological research. Some technical equipment, such as "scuba" and other devices used by amateur divers, is already available. This, together with specialized techniques, some already developed, makes it possible to carry on archaeological research under water. The action of water is not always destructive. In fact, certain kinds of lakes act to preserve objects, either organic or metallic, which would be destroyed out of water. The objective of underwater research, then, would be twofold: (1) to recover data endangered by too long exposure to the destructive action of water, and (2) to recover data protected by the preservative action of water.

"IT IS EASIER," says Diolé (1954) "to make a diver of a scientist, than a scientist of a diver." This observation, originally made with respect to marine archaeology, may apply to inland or fresh waters as well. Indeed, with increasing popularity of underwater exploration as a recreational activity, there is an urgency in this matter (compare Goggin 1960). The search for underwater antiquities has become a hobby.

There are, in general, two kinds of underwater archaeological situations: those in which cultural materials have been introduced into existing bodies of water, and those in which cultural sites have become inundated by submergence or damming. The latter process is occurring at an accelerated rate. In the United States, for example, nearly a third of the fresh water bodies have been artificially created by dams, and the U. S. Bureau of Reclamation notes that additional projects already authorized will double that amount. It is evident that vast prehistoric cultural areas are threatened with inundation. This paper will attempt to show that, contrary to common impression, an underwater archaeological site is not necessarily inaccessible or destroyed; rather it might be well preserved, protected, and perhaps excavated with greater ease than if it were on land.

With respect to precedent, it appears that experience with fresh water archaeology has been confined to the first type of situation described above, the removal of intruded artifactual materials from existing lakes. The Peabody Museum, Harvard University, probably pioneered this approach with the dredging of the Sacred Cenote at Chichén Itzá in 1905–08. In 1956, E. Wyllys Andrews supervised divers in the cenote at Dzibilchaltún, Yucatán. John M. Goggin of the University of Florida is diving for artifacts in that state's fresh-water bodies. The recent work of S. F. Borhegyi (1958) at Lake Amatitlán is an exemplary application of techniques to this new science.

There appears to be no literary reference to an excavation of an archaeological site under water. My experience with this latter approach has been to make underwater return to several Central California Indian mounds that have been under water for from two to ten years, all of which were partially excavated prior to inundation by damming, and to experiment with them sufficiently to demonstrate how their archaeological examination could continue. Before doing so, however, it might be well to give attention to the environment in which the underwater archaeologist will work, and some of the processes that occur there that are of significance to archaeology.

Characteristics of Lakes Relative to Archaeology

Hutchinson (1957) has classified lake basins according to the general nature of the processes of formation. He defines 76 types in a system which may be applied archaeologically. Most underwater excavations would be pursued in the classification, Lakes Produced by the Complex Behavior of Higher Organisms: Type 72, beaver dams; Type 73, dams built by man; Type 74, excavations made by man, as the abandoned diamond mines at Kimberley, South Africa.

Lakes have a tendency to become thermally stratified. The upper, warm circulating water is the epilimnion, and the lower, colder, non-circulating water is the hypolimnion. In contrast to these two zones with their stable temperatures, is the stratum between them known as the thermocline, which is characterized by a rapid decrease in temperature with depth. It occurs variously at 5–10 m. below the surface. In the temperate zone these layers will undergo at least semi-annually an overturn in which

* Presented in modified form at the 58th Annual Meeting of the American Anthropological Association, Mexico, December, 1959.

the epilimnion replaces the hypolimnion. In the polar zone the warmer (but relatively cold) water will generally remain on the bottom. In the tropics there is a tendency for little circulation to occur and for the coldest water to remain on the bottom, usually becoming stagnant and foul. The significance of this for archaeology lies in the fact that thermal stratification affects properties of water. These properties, in addition to others that will be briefly discussed, determine whether or not inundated cultural materials are preserved.

Natural Factors of Underwater Preservation

The preservation of an underwater artifact depends upon whether it is an organic or a metal object with respect to several environmental factors. Paramount among these factors are: (1) water temperature, (2) dissolved oxygen, (3) dissolved minerals and acids, and (4) sedimentation.

Corrosion of metals by water is an electrochemical process accompanied by the flow of current between areas of surface where metal passes into solution, usually termed "anodes," and other, uncorroded, areas where hydrogen is discharged as a gas or oxidized, usually termed "cathodes." When two metals are joined together, one may act wholly as anode and the other as cathode (although both may have areas of the two types), thus sometimes preserving one of the metals. This was illustrated recently with the discovery of the remains of some rifles in Lake George, New York, that were estimated to have been there for 200 years. The diver who found them reported: "Although the ferrous metal is largely corroded away, the brass work is still bright." He also indicated, incidently, that fragments of the leather were still attached (Parker 1958).

Corrosion of metals can be retarded or inhibited by alkaline solutions, protective deposits of calcium carbonate or silica, cold water, or the lack of oxygen. Speller (1951: 8), states that in natural waters, the rate of corrosion is almost directly proportional to oxygen concentration if other features do not change. A lake with a hypolimnion will normally be lacking oxygen in its depths (except during the temporary period of the overturn in the temperate zone), as will lakes that are stagnant or so fouled with organic deposition that the bacterial need for oxygen outpaces the supply, such as occurs in the tropics or in peat bogs. In the latter case, naturally formed acids may corrode metals while preserving organic materials. Although peat bogs have yielded metal artifacts of great antiquity, they are richer in organic evidences of man. Cornwall (1958) discusses this process in detail.

Corrosion may proceed in warm water (above about 15° C.) because of the biochemical action of anaerobic organisms, so it is more often in lakes north of the tropics that metals are preserved. Common metals known to have been preserved in fresh water for periods of time varying from 200 to 2000 years are tin, copper, brass, iron, steel, bronze, and lead.

Organic materials are preserved in fresh water by somewhat different circumstances. Their decomposition is due to a microbian or biochemical process. The lack of oxygen retards this process, as do temperatures below about 15° C., and other aqueous situations that kill or incapacitate bacteria and molds. There are, of course, a number of locally unique situations producing factors of preservation: dissolved tannic acid from surrounding oak trees and the like, for example, and the sterilizing effect of hotsprings. Twenhofel (1950) has shown that substances decay in water at different rates. The microbian sequence is: (1) proteins, carbohydrates, cellulose; (2) lignans; (3) fats, waxes, gums, and resins. This sequence may take centuries to run its course. Thus, one should be alert in the water for adipocerous materials which are not easily identified in darkness or ooze, and are often very fragile.

Skin divers in northern California have discovered that cold water preserves organic objects by surfacing sunken logs derived from lumbering operations of 80 to 100 years ago that are indistinguishable from recently cut timber. The logs are found at only a depth of about 6 m., but in temperatures under 15° C. (Himmel 1959). The cenote at Dzibilchaltún serves as another example of the frequently preservative action of water, for Andrews has informed me that the only wooden artifacts of the site have been derived from it. Both wooden artifacts and textiles were recovered from the Sacred Cenote at Chichén Itzá.

It should be remarked that these principles of underwater preservation may often apply to water saturated soils. For example, while recently engaged in an archaeological investigation of the century-old Fort Humboldt in northern California, I observed that the only fence-post stumps that hadn't rotted away were in moist, cool soil. This subject of the preservation of organic matter in waterlogged soils has also been touched upon by Cornwall (1958).

Archaeological sites that have become inundated by damming are affected in different ways. Middens that come to be under water in quiet coves tend to have much of their surface carried off in suspension. A black "cloud" of this material hovers in the water over the mound and is often visible from the air. This process may persist for several years. If the mound happens to lie in the course of a strong current of water, it is often greatly deteriorated. Preservation occurs best where only a slight current exists, in which case the mound normally becomes silted and is indistiguishable from other underwater features.

Some Techniques of Fresh-Water Archaeology

The mapping of an underwater site commences with a bathymetric projection that may be best obtained from an aerial photograph of known scale. A datum point can then be fixed from which soundings may be taken from shore. Although rods or lead lines may be used, they are not as accurate or convenient as one of the commercially made electronic depth sounders, such as the Raytheon Fathometer. Establishing a grid system upon the area to be excavated may be accomplished by lowering a prefabricated network of light cable over the site.

Frequently it becomes difficult to locate a site because of the altered topography resulting from damming, or because of silting. The bottom may then be examined with a core sampler. Although commercial core samplers are available that may be operated from the surface, Mackereth (1958) describes one of his own design that appears to be ideal for adaptation to archaeology. Easily handled by two men in a row boat, the instrument functions pneumatically without the use of heavy weights, and can obtain cores 6 m. in length.

The use of an underwater metal detector is also recommended. One which I have used (Goldak model UD–11) generates a field extending 3 m., and operates on four standard flashlight batteries; it is sturdy, light, and economical.

Descent is accomplished with the aid of equipment commonly called "scuba" (self contained underwater breathing apparatus). The diver breathes from tanks of compressed air carried on his back. Once trained in the use of this equipment, and if one's health permits it, it is possible for one to work at depths of 30 m. or more without undue hazard or discomfort.

Underwater photography requires special education because of the altered focal length and light occurring in the depths, along with one's loss of color perception. Plastic cases may be easily made or purchased for all standard photographic equipment. A current reference on this topic is *Underwater Photography* (Schenck and Kendall 1958).

A suggested method of underwater excavation is to begin with a small suction dredge similar to those used in small streams for mining gold. With this tool it is possible to gently "vacuum" surface litter and silt, while screening on the surface for objects passing through the hose. Such a dredge can typically remove from 5 to 6 cubic meters of silt per hour, and will pass material up to about 3 cm. in circumference. When the surface of the site has been exposed or cleared, the dredge should be abandoned in favor of an ordinary pump. Mud can be sucked to the surface for screening, leaving larger objects to be retrieved by hand. A considerable amount of skill may be developed with this technique in exposing artifacts, burials and the like, and in doing stratigraphic analyses. Some features, however, such as house floors, may go unobserved under these conditions.

Obviously the techniques discussed above lack the refinements of orthodox archaeology, but it is hoped that they will improve with experience. Meanwhile, underwater archaeology should supply valuable information that might be otherwise lost under heavy silting or through erosion.

Summary

This paper has attempted to encourage an increased interest in fresh-water archaeology for three reasons:

1. Because of the increased inundation of archaeological sites, many of which may be destroyed or heavily silted by the process, and some of which may be vandalized by amateur activity, there is an urgent need for more participation in this area of research.

2. The frequently preservative action of water, with its regional and local variations, helps to supply evidence that would be otherwise unavailable.

3. Techniques and equipment that may be adapted to underwater research with considerable efficiency are available to the archaeologist.

Acknowledgment. I am grateful to the Central California Archaeological Foundation for supporting most of the field work involved in the preparation of this paper.

Borhegyi, S. F.
1958 From the Depths of Lake Amatitlan. *Illustrated London News*, Vol. 233, pp. 70–2. London.

Carrier, Rick and Barbara Carrier
1955 *Dive*. U.S. Divers Corp., Los Angeles.

Cornwall, I. W.
1958 *Soils for the Archaeologist*. Macmillan, New York.

Diolé, Phillipe
1954 *Four Thousand Years Under the Sea*. Julian Messner, New York.

Goggin, J. M.
1960 Underwater Archaeology: Its Nature and Limitations. *American Antiquity*, Vol. 25, No. 3, pp. 348–54. Salt Lake City.

Himmel, Nieson
1959 Sunken Treasure Below. *Skin Diver Magazine*. Vol. 8, pp. 16–17. Lynwood (California).

Hutchinson, G. E.
1957 *A Treatise on Limnology*, Volume I. Wiley, New York.

Mackereth, F. J.
1958 A Portable Core Sampler for Lake Deposits. *Journal of Limnology*, Vol. 3, pp. 181–91.

Parker, Gene
1958 Historical Discovery. *Skin Diver Magazine*, Vol. 7, pp. 24–25. Lynwood (California).

Schenck, H. and H. Kendall
1958 *Underwater Photography*. U.S. Divers Corp., Los Angeles.

Speller, F. N.
1951 *Corrosion, Causes and Prevention*. McGraw-Hill, New York.

Twenhofel, W. H.
1950 *Principles of Sedimentation*. McGraw-Hill, New York.

4301 Sycamore Ave.
Sacramento, Calif.
March, 1960

QUANTITATIVE ANALYSIS OF SHELLS FROM A SITE IN GOLETA, CALIFORNIA

Roberta S. Greenwood

Abstract

This shell study was designed to test and perfect methods of quantitative analysis in addition to providing the usual identification of species. Experiments were performed to determine the optimum size of sample, dimension of screen, number of samples, and the practicability of rapid analysis in the field to guide the progress of excavation. Analysis of variance was used to measure up to five variables at once; differences were shown graphically with direction of change indicated by a least-squares regression line. The analysis of 69 excavation units revealed an overwhelming preference for mud-dwelling species which showed no change in horizontal distribu-

tion over the site, and except for some decrease through time in the popularity of *Ostrea*, no vertical changes. The methodological experiments demonstrated that a 500-gram sample produces as accurate a measure of the shell in a level as the total sample from the level, that a ¼-inch screen is adequate when brittle types such as *Mytilus* and abalone which break into very small fragments are absent or present in only small quantities, and that rough field sorting produces results which correlate well with those based on closely controlled laboratory analysis.

IT IS GENERALLY AGREED that early man must be studied in relation to his ecological adaptation. Since cultural reconstruction depends on more than the mere inventory of artifacts recovered from a site, molluscan remains, where present, constitute one of the most important components of cultural debris. They preserve well, are readily identifiable, and are susceptible to quantitative analysis. They offer testimony to the source and variety of food supplies, indicate changes in dietary preference or climatic conditions through stratigraphic analysis, reveal the nature of raw materials available for artifact manufacture, and can be further employed to suggest size of population and duration of site occupation. Since the quantitative investigation of shell middens is a comparatively recent technique, the methods and objectives have varied greatly. Only a few writers have done so much as list the varieties of shells found in the hundreds of shell mounds excavated, let alone compute relative frequencies (Meighan and others 1958: 1). Where analysis has been attempted, there is a wide range in such factors as size of sample, size of screen, number of samples, excavation technique, and statistical method. The shell study at Goleta was designed to examine these variables, in addition to supplying the usual ecological evaluation. Another objective was to test the hypothesis that random samples could be sorted quickly and accurately in the field. The identification, weighing, tabulating, and interpreting of shell remains has been traditionally performed indoors, often far from the site and usually after the excavation has been completed. Such results may be valuable, but they come too late to guide the archaeologist in his fieldwork. If proved practicable, field sorting could be used to advise the digging crew about horizontal and columnar distributions in time to modify the excavation schedule if that seemed advisable. The illustrative material cited comes from the excavation of SBa–60, a salvage operation performed by the Archaeological Survey, University of California at Los Angeles. The site, in the town of Goleta, was dug in January and February, 1960.

A total of 69 samples was analyzed. Of these, 40 represented laboratory samples taken from the 4-inch levels of Control Pits 1 and 2, and Control Columns 1–4, excavated by precision methods, and subjected to fine analysis. The term "control column" is used to refer to a free-standing, isolated column 3 feet square. Twenty-six samples were sorted roughly in the field from the regular excavation units dug in 6-inch levels. Additional experiments were performed by screening some of the samples through ½-inch, ¼-inch, and ⅛-inch mesh, and by comparing the analysis of the total volume of shell obtained from a level with the results of sorting a random 500 grams from the same sample.

The first problem concerned the size of sample necessary for accurate representation of the species and their proportions. Procedures have varied widely in the past. Gifford (1916) reported on samples ranging in weight from 31 to 833 grams, averaging 119. Treganza and Cook (1948: 292) found that "a component of the site which appears in large quantity and in a reasonably fine state of subdivision may be estimated with a fairly high degree of precision by the small sample technique," and suggested samples of 1–5 pounds (453.6–2268 grams). Cook and Heizer (1951) recommend a sample 3 by 3 by 12 inches containing 108 cubic inches of total content, regardless of the amount of shell contained. They conclude that there is very little improvement in accuracy in using few, but very large samples. Greengo (1951) weighs out 500–1000 grams from an unscreened total volume sample of 90 cubic inches, but does not indicate the weight of shell retained in the screen. Ascher (1959) selected samples of 2000 grams before washing and screening, and choosing those from the area of most intense occupation, worked on samples with a net shell weight ranging from 280 to 623 grams.

One hazard of depending on volume criteria rather than weight is the likelihood of ending up with sets of statistics which are not statistically comparable. For example, writers who employed a volume standard of 96 cubic inches were forced to compare shell samples varying in weight from 393.5 to 12.5 grams (McKusick and others 1959: 98). The percentages of shell produced by dry weight analysis of a given measure of volume are clearly useful in determining comparative density of site occupation, but means of proportion and other computations made from samples of such varying dimensions can be misleading when manipulated to illustrate stratigraphy or other quantitative considerations.

An experiment was made to discover how the results of analyzing the total volume of shell recovered from one level would compare with the results obtained from a 500-gram sample weighed out at random from the total. The figures in Table 1 illustrate a striking correlation, suggesting that 500 grams constitutes an adequate sample. The Chi-square test verified that the smaller sample is a true measure of the universe, and 500 grams weighed out

TABLE 1. PERCENTAGES OF SPECIES, CONTROL PIT 2, LEVEL 2.

Species	*Total Shell Sample 1110 grams*	*Partial Sample 500 grams*
Chione simillima Sowerby	50.4	50.7
Chione californiensis	5.7	4.0
Protothaca staminea Conrad	28.6	31.6
Ostrea lurida Carpenter	8.7	7.9
Macoma nasuta	1.7	1.7
Saxidomus nuttallii	0.6	1.3
Plagioctenium circularis aug. Carpenter	0.2	0.1
Tivela stultorum Mawe	3.2	1.6
Crepidula onyx Sowerby	0.1	
Unidentified	0.8	1.1
	100.0	100.0

at random from the total shell content of each level became the standard sample for this study.

Next we attempted to determine the optimum size of screen, mindful of considerations both of accuracy and time. Here, too, procedures have differed greatly. Gifford (1916: 6–7) experimented with 12-mm., 4-mm., and 2-mm. screens, and found that the figures varied according to the nature of the midden; at Gunther Island, 87% of the material passed through his finest screen, while at San Mateo, he lost only 41%. The results also varied by species; 70% of the mussel remained in the fine screen, while 51% of the *Macoma* and 60% of the oyster were caught in the medium screen. Treganza and Cook (1948) employed the ⅛-inch mesh in 1947, and ⅛-inch in 1948. In 1951, Cook and Heizer (1951: 291) disregarded all material less than ⅛ inch as "impossible to analyze without a prohibitive amount of labor and expense." Greengo (1951: 9) prefers the ⅛-inch size, and omitted an earlier sample from Bodega Bay because it was only sifted to ¼ inch. However, it should be noted that the predominant species in this site is *Mytilus*, up to 87.2%, which Gifford and Greengo both have shown tends to fracture into the smallest particles.

Ascher (1959) employed statistical analysis to establish the proportions of the total midden content which would be caught by ¾-inch, ¼-inch, ⅛-inch, and $\frac{1}{16}$-inch screens, and did the same for the combined shell component, but did not present any data for the individual species. He preferred the $\frac{1}{16}$-inch mesh, probably because he was attempting a population estimate for his site, and the density of occupation, as revealed by dry weight analysis, would be the significant measure. He did state, "the overwhelming amount of shell" was mussel; this might also have affected the choice of screen since it has been observed that mussel reduces to very small fragments. He concludes that his work is applicable only to his site at Zuma, and that best screen size must be determined in each case (Ascher 1959: 176–7). The Archaeological Survey in its recent work at Anacapa (McKusick and others 1959: 80–1), San Clemente (McKusick and Warren 1959: 147), and Del Mar (Warren and Thompson 1959: 220) worked with a ¼-inch mesh, in the belief that this size was accurate enough to permit generalizations about population shifts and ecological relationships, in addition to reducing drastically the sorting time expended.

At Goleta, two tests were made to evaluate these varying opinions, as well as to determine the optimum screen to employ on this project. The material from one level of one pit was subjected to ½-inch, ¼-inch, and ⅛-inch screening, and then two entire, adjacent pits were compared, one screened to ½ inch and the other, to ¼ inch. In neither case was there any significant difference in the analysis of variance. This useful statistical method allows five separate elements of variance to be considered: levels, pits (or screen size), species, pits and species together, and experimental error. The experimental error is a statistical device whereby all error introduced by chance sampling or other uncontrollable extraneous factor may be computed out before the variances are measured.

This method makes it possible to compare any number of groups of data at once. While it does not yield an exact measure of relationship as provided by the coefficient of correlation, it produces a ratio which, by means of the F-table computed by Fisher and Snedecor for each combination of degrees of freedom, may be expressed as (1) not significant, (2) significant, (3) highly significant, or (4) clearly above a ratio of high significance. A significant ratio is defined as one which would occur by chance sampling only one time out of 20, or in 5% of cases; a highly significant ratio is so large that it could occur by chance only one time in 100, or in only 1% of the cases. The results of this analysis may be summarized here by stating that the F-ratios between levels and pits were each below the critical standard of significance. In other words, the samples were drawn from the same universe, and the size of the screen made no difference.

As a result of these experiments, we adopted a 500-gram sample of shell screened to ¼ inch as the standard for all other field and laboratory classification. The shell study at Goleta was not intended to yield a population estimate, but rather to determine molluscan species and their frequencies. Since the predominant varieties maintained their position on the ½-inch screen, the easily fractured *Mytilus* appeared as only 1.1% even on the ⅛-inch mesh, and the percentages of species identified by ¼ inch closely approached the mean of the three sizes, it was felt that the desired information about ecological relationships on this site could be obtained with accuracy and speed by use of the ¼-inch screen.

The combined means of proportion of the 69 samples are shown in Table 2. The *Chione*, *Protothaca*, *Saxidomus*, *Macoma*, *Plagioctenium*, and *Tivela* are all inhabitants of mud flats or sandy bottoms, indicating that 95.9% of the shellfish diet may have been obtained in the Slough or its inlet. The *Olivella*, *Conus*, abalone, and

Table 2. Percentages of Species Identified in 69 Samples

Species	Per cent
Chione simillima Sowerby*	53.7
*Chione californiensis**	5.2
Protothaca staminea Conrad	23.0
Ostrea lurida Carpenter	11.3
Macoma nasuta	1.3
Saxidomus nuttallii	1.4
Plagioctenium circularis aug. Carpenter	0.8
Tivela stultorum Mawe	0.5
Crepidula onyx Sowerby	0.2
Mytilus californianus or *M. edulis*	0.1
Unidentified	2.3
	99.8
Less than 0.1 per cent	
Cerithidea californica Haldeman	
Astrea undosa Wood	
Tagelus californianus Conrad	
Septifer bifurcatus Conrad	
Haliotis	
Conus californicus Hinds	
Olivella biplicata Sowerby	
Lucapinella callomarginata	
Cardium corbis Martyn	

* The two varieties of *Chione* combined account for 58.9% of the total shell sample.

mussel were apparently sought as raw material for artifact manufacture rather than as a primary food source. In fact, the only specimen of *Conus* recovered had been drilled as a bead.

The next objective was to compare the accuracy of rough field sorting with the work done in the laboratory. Fieldworkers were instructed to fill a box with a generous estimate of the weight required, and to disregard all other shell from that level. A person familiar with the species then sorted the shell at high speed, spending 15 minutes or less on each 500 grams. The only other difference from indoor procedure was the necessity of providing a windscreen for the scale. The results (Table 3) proved that in spite of the less refined methods and greater amounts of residue in the samples, the percentages of component species were comparable to those obtained from fine laboratory analysis, accurate enough to guide the field supervisor, and rapid enough to keep pace with the excavation.

It remained to be determined whether there was variance in the vertical, or columnar, distribution of the species, or in horizontal frequency. If demonstrable, the former would furnish stratigraphic information, and the latter, clues to the nature of — or change in — site occupation. The analysis of variance was computed for *Chione simillima, Protothaca,* and *Ostrea* to see if there was change in proportion in the nine levels of Control Columns 1, 2, and 3. The calculations proved no change in the *Chione* or *Protothaca* from top to bottom of the excavation. However, a highly significant difference appeared in the proportions of *Ostrea* (F=15.47, with eight degrees of freedom). Since this statistical method measures a ratio of change, but not its direction or degree, the data for *Ostrea* were next fitted to a regression line by the least-squares method. The equation, Y=6.72+.429 X, was plotted, as shown in Figure 1.

There was no complementary change in other species to compensate for the trend of *Ostrea*. For both *Chione* and *Protothaca*, the regression is very close to a straight horizontal line, reinforcing the "no difference" result of the variance tests. As less *Ostrea* was consumed in more recent times, the prehistoric people simply made up the difference with whatever came to hand, rather than by a distinct shift to another species.

From a comparison of the horizontal distribution of species over the extent of the site, there appears to be little difference in the nature of the occupation. There is no evidence of different food preference or varying availability of species. Although Control Pits 1 and 2 were approximately 130 feet apart, the percentages of the predominant species are almost identical. The same correspondence occurred in the analysis of Control Columns 2, 3, and 4, although Column 2 was situated 50 feet from Column 3, and Column 4 lay 120 feet in the opposite direction. The data were subjected to the analysis of variance which proved that the site was homogeneous in its lateral dimensions.

Table 3. Means of 40 Laboratory and 26 Field Samples

Species	*Laboratory Samples*	*Field Samples*
Chione simillima Sowerby	52.3%	57.5%
Chione californiensis	5.7%	6.3%
Protothaca staminea Conrad	24.6%	20.2%
Ostrea lurida Carpenter	11.7%	9.9%
	94.3%	93.9%

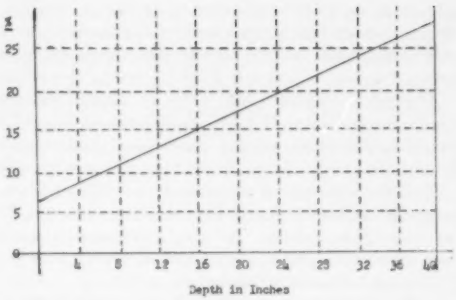

Fig. 1 [Greenwood]. Least squares regression line for the change in proportion of *Ostrea* in Control Columns 1–3. Sy=4.69.

The analysis of the 69 excavation units thus made revealed the following ecological information, with statistical certainty:

1. 93.2% of the shellfish diet consisted of *Chione simillima, Chione californiensis, Protothaca staminea,* and *Ostrea lurida.*

2. 95.9% of the shellfish consumed were mud-dwelling species which might easily have been obtained in the Slough.

3. There was no change in the proportions of the four predominant species, as distributed horizontally over the site.

4. There was no change in the proportions of the two *Chione* or *Protothaca* from top to bottom of the excavated depth; *Ostrea* tended to increase in the lower levels.

The methodological experiments demonstrated that a sample of 500 grams of shell was as accurate a measure as the total amount recovered from a level. For this site, where the brittle *Mytilus* and abalone constitute only trace elements, and the predominating species have comparable resistence to fracture, the ¼-inch screen was judged accurate enough to trace the ecological relationships desired. Since the standard error of the mean for *Chione simillima, Protothaca staminea,* and *Ostrea lurida* was respectively 1.35%, 1.0%, and 0.76%, the data fall well within the 5% critical definition set by Treganza and Cook (1948: 289) for a homogeneous universe. By this formulation, analysis of 25 samples would have been adequate.

It was also established that rough field sorting produces results which correlate well with those based on closely controlled laboratory analysis. In this particular case, there was no evidence of cultural change from one end of the site to the other, but where there is cultural variety, field sorting is practicable, accurate, and rapid enough to

give guidance to the excavation team. Used with dry-weight analysis, field sorting would also indicate areas of richer occupation debris in time for this information to be useful.

The use of applied mathematics in midden analysis adds a precise tool to the archaeological inventory. The data compiled on screen size, sample size, horizontal and vertical distributions, and such, were subjected to the analysis of variance, and where significant difference was indicated, the statistics were fitted to a regression line by the least-squares method. By using standardized systems and quantitative analysis, the archaeologist may obtain convincing evidence to support his conclusions. These procedures would be equally applicable to the study of skeletal, artifactual, or other ecological remains, and would add authority to the theories derived from such analysis.

Ascher, Robert
1959 A Prehistoric Population Estimate Using Midden Analysis and Two Population Models. *Southwestern Journal of Anthropology*, Vol. 15, No. 2, pp. 168–78. Albuquerque.

Cook, S. F. and R. F. Heizer
1951 The Physical Analysis of Nine Indian Mounds of the Lower Sacramento Valley. *University of California Publications in American Archaeology and Ethnology*, Vol. 40, pp. 281–312. Berkeley.

Gifford, E. W.
1916 Composition of California Shellmounds. *University of California Publications in American Archaeology and Ethnology*, Vol. 12, No. 1, pp. 1–29. Berkeley.

Greengo, R. E.
1951 Molluscan Species in California Shell Middens. *Reports of the University of California Archaeological Survey*, No. 13. Berkeley.

Meighan, C. W., and others
1958 Ecological Interpretations in Archaeology: Part I. *American Antiquity*, Vol. 24, No. 1, pp. 1–23. Salt Lake City.

McKusick, M. B., and others
1959 Introduction to Anacapa Island Archaeology. *Archaeological Survey, Annual Report*, 1958–59, pp. 71–104. University of California, Los Angeles.

McKusick, M. B., C. N. Warren, and others
1959 Introduction to San Clemente Island Archaeology. *Archaeological Survey, Annual Report*, 1958–59, pp. 105–183. University of California, Los Angeles.

Treganza, A. E. and S. F. Cook
1948 The Quantitative Investigation of Aboriginal Sites: Complete Excavation with Physical and Archaeological Analysis of a Single Mound. *American Antiquity*, Vol. 13, No. 4, pp. 287–97. Menasha.

Warren, C. N. and H. P. Thompson
1959 Test Excavations at the Del Mar Site (Sdi-191). *Archaeological Survey, Annual Report*, 1958–59, pp. 217–31. University of California, Los Angeles.

725 Jacon Way
Pacific Palisades, Calif.
April, 1960

SOME ANCIENT SITES IN GREENSBERG AND OTTAWA TOWNSHIPS, PUTNAM COUNTY, OHIO

Frederick Johnson and O. J. Neill

Abstract

A collection of artifacts found in the lip of a terrace of the Blan hard River in northwestern Ohio comes from 17 presumably ancient sites which had not been used by peoples of Archaic and later stages of culture development. The artifacts are made of fine-grained cherty rock which is not known to occur in the region. The tools consist of fluted and other kinds of points, a wide variety of scrapers, "utilized flakes" with sheared edges or edges made by a high quality pressure retouch, gravers, burin-like tools, and other specialized artifacts. It is suggested that these may represent an occupation of the region by pre-Archaic stage peoples.

FOR MORE THAN 20 years, Neill has been collecting chipped stone and other artifacts from the terraces bordering the Blanchard River in Greensberg and Ottawa townships, Putnam County, Ohio. All of the sites have been disturbed by the deep plowing characteristic of the agriculture of the region to an extent which renders detailed archaeological excavation nearly impossible. The task which has been accomplished is, in truth, a salvaging of the archaeological material by systematic surface collecting and intelligent observation of minute details.

The collection is clearly divisible into three groups of material, such classification being based on the character of the artifacts and even more clearly upon their location along the river. Pottery and stone artifacts from sites on the bottom land represent the local expression of the Fort Ancient aspect. Stone tools, also from the botttom land, but occasionally from the terrace, are very similar to Archaic stage materials identified in adjacent regions. Other stone tools, found invariably in locations indicating their origin in the lip of the terrace, and easily distinguishable by their lithology, are widely distributed but not well known in North America. These latter tools are the principle concern of the following remarks.

The Blanchard River in northwestern Ohio is a tributary of the Auglaize River. The two drain much of the region between the beaches of glacial Lakes Maumee and Whittlesey. The western part of the area south of the Whittlesey beach is occupied by the Defiance Moraine. The Blanchard River lies south of the Moraine and drains a region known to geologists as "Ottawa Bay." The river is confined by a low terrace averaging about 20 feet high. This terrace is composed of silty gravels which rest on a deposit which we cannot identify precisely but which Richard Goldthwait informs us is probably till. Geological investigations in the area are incomplete, and as far as we can discover, the origin and significance of the terrace and its underlying deposits in the local landscape is not known. The river has been incised into the ancient surface of the region, but this does not completely explain the presence of the terrace. The gravels are blanketed by a topsoil containing a large amount of humus. This can be 2 feet or more deep.

Some 17 sites where artifacts are found have been located. No evidence of occupation, other than the stone tools and occasional chips has yet been observed and it is impossible to delimit specific areas of occupation. Fifteen sites are located along slightly more than 4 miles of river bank, that is, between Caton Ditch and Pike Run. The number of artifacts from each locality is very small; the collection may indicate simply widely distributed occupation of the terrace during a single period. Speci-

mens from locations 4 and 5 miles west extend the locality downstream, but give no further clue to the distribution of the population.

The artifacts have been exposed by plowing and erosion. Plowing parallel to the lip of the terrace has moved the topsoil down slope. The lip of the terrace is frequently marked by a vertical face in the soil about 2 feet high. On the slope in front of this face the topsoil may be eroded away exposing the surface of the underlying "till" for a distance varying from a few to 60, 70, or even 80 feet. The artifacts are found on the surface of this eroded zone at varying distances from the face of the terrace. Rarely they have been discovered down slope on the surface of the topsoil. They have never been found on the surface of the tread of the terrace, on the bottom land or, unfortunately, weathering out of the face. The evidence for the original provenience of the artifacts at or near the bottom of the topsoil on the terrace is circumstantial but constant repetition of the conditions lends considerable support to the hypothetical reconstruction. Probably the artifacts were deposited on the original terrace surface, or near it in the topsoil. Plowing and erosion finally moved the soil down slope exposing the stone tools. This leads to an opinion that the tools may be of considerable antiquity. However, the time when they were deposited and the conditions which existed then cannot be inferred from our present knowledge.

These early sites were not used by the later peoples; they preferred the bottom lands. However, there is a scattering of artifacts, invariably of Archaic stage types, present on some sites. There is no suggestion of a consistent pattern in type or in distribution, and it is assumed that this occurrence is due to accidental mixture on a thoroughly disturbed surface.

The ancient artifacts are, with very rare exceptions, made from different types of fine-grained cherty rocks which are not known to occur in the region, or even near it. The stone is sometimes deeply patinated. Tools made from local rocks are not patinated. Archaic and later peoples also made tools from local rocks, but did not use the cherty material.

A fluted point (Fig. 1 *a*) probably of chert but heavily patinated was a somewhat isolated find having been picked up to the east of a group of sites on the south bank of the river. A brown chert core and a snub-nosed scraper were found close by, and the sites produced scrapers, utilized flakes, and gravers and occasional Archaic type artifacts. As this was being written a second fluted point was reportedly found on the banks of the Blanchard River some 15 miles to the east in Gilboa, Ohio.

The point has rather distinct shoulders, which is a little unusual, but these do not appear to be due to resharpening. Flutes on both sides of the implement had been formed by removal of a single chip. The fluting chip runs the full length of the obverse and but about half the length of the reverse of the implement. The edge of the concave base of the reverse face has been finely retouched obliterating all evidence of the technique of removal of the flute chips. The sides have been ground. This point may be classified as a variety of the Eastern Clovis Fluted type. It is similar to some points found at the Schoop site (Witthoft 1952); details of the size, shape and technique have no counterpart at the Bull Brook site in Massachusetts (Byers 1954) or the Reagan site in Vermont (Ritchie 1953).

Possibly a basal section (Fig. 1 *b*) is part of a fluted point. Two longitudinal flakes have been removed to form flutes on the obverse. On the reverse there appears to have been an unsuccessful attempt to form a flute. The specimen vaguely suggests the Enterline industry of Pennsylvania (Witthoft 1952).

The fragment of a tapering stem (Fig. 1 *c*) comes from the same site as the basal section described above. This is nicely chipped and finely retouched along the edges. The right hand side, as illustrated, has been ground. The left hand side has also been ground but the central portion has been modified by the removal of a spall probably by frost from the obverse side. The shape of the piece suggests points having their maximum breadth between the midpoint and the tip. Points of this kind are not common in the eastern part of the Middle West and they become increasingly rare to the east of the Ohio drainage. The shape suggests some of the Agate Basin points of Wyoming, but this is not to imply a connection between Wyoming and Ohio.

The leaf-shaped blade (Fig. 1 *d*) is very expertly made from a piece of chert. It is relatively thin, quite symmetrical, and the edges are sharp. The only feature which distinguishes this blade from analogous Archaic stage tools is the unusual symmetry and fine workmanship.

A lanceolate-shaped point having a straight base (Fig. 1 *e*) has been roughly chipped out of chert. The crudeness of this specimen prevents classification with any specific eastern type of lanceolate point. Such points are also characteristic of the Archaic stage. The stone used suggests that it may be included with the ancient tools.

Scrapers of several varieties far outnumber other kinds of tools in the collection. The term scraper is applied here specifically to tools which have one flat face which is the face of the chip from which the tool was retouched. Rare specimens exhibit faces which have been flattened by some minor trimming. The opposing faces of the scrapers are usually rough and vary greatly. They are the result, largely, of trimming the chip down to the required size and the sharpening of the edge. Actual manufacture of the scrapers may not have involved trimming to preconceived forms but a number of shapes do appear in the course of classification. Another distinguishing characteristic of these scrapers is the "vertical chipping" along the useful edges. This curious term has been applied to the retouching of edges which lie at angles varying from about 45° to nearly 90° with the flat face. There is no evidence on the scrapers in this collection that their shape, and the character of their edges, has been modified by resharpening.

Snub-nosed scrapers have at least one convex edge exhibiting the vertical chipping. They may be retouched only along this edge (Fig. 1 *f, g*), or part of the tool not involved with the scraping edge also may be trimmed (Fig. 1 *h, i*). The latter kind of scraper may taper to a

Fig. 1 [Johnson and Neill]. Artifacts from the terrace of the Blanchard River in northwestern Ohio.

blunt point (Fig. 1 *h*), or it may be oval or round (Fig. 1 *i*). Snub-nosed scrapers may be made from rectangular flakes which are retouched on the thickest end (Fig. 1 *j–l*). A form of scraper, possibly intermediate between the snub-nosed type and a type with a definite graver point, is made by retouching a side to intersect with the scraping edge so forming a sharp corner or point (Fig. 1 *g*).

Scrapers were made in many shapes. A scraping edge could be worked on any suitable chip to make a tool, presumably for immediate or special, but temporary use. The variations prevent useful classification; the illustrations roughly indicate the small size and character of most of these. A very small irregular flake tapers in cross section from about one quarter of an inch at the thick edge, which is retouched, to less than $\frac{1}{16}$ inch (Fig. 1 *m*). The thick end of a tiny chip has been retouched with the vertical chipping (Fig. 1 *n*).

One end of the cutting edge of snub-nosed scrapers may be formed in various ways into a spur or graver point. An uncommon form (Fig. 1 *o*) has, on the right hand corner, a notch made by removing a number of small chips. These leave a sharp corner to the left and a well-developed spur to the right of the notch.

A snub-nosed scraper which has a well-formed graver point on its right side is illustrated in Figure 1 *q*. The front face is shown to the left. To the right, the opposing face exhibits the retouching which was done to form the graver point. This retouching is opposite from the direction of chipping the scraping edge. The graver point was carefully sharpened by fine retouching, after it had been roughed out by the removal of several large chips. A scraper with a similar, but somewhat blunter point located on the left side as illustrated in Figure 1 *p*.

Two other scrapers illustrate varieties which have less prominent spurs. The first has a left hand edge sharpened along its entire length. The resulting graver point is more prominent than indicated in the photograph (Fig. 1 *r*). Another specimen is the result of retouching the edge just far enough to form a graver point (Fig. 1 *s*).

A distinguishing feature of this collection is the large number of tools made from flakes. They are of a variety often called "utilized flakes"; they vary considerably in size and shape, having no characteristic form. Presumably the flakes were selected at random, trimmed and sharpened for a specific purpose, used a few times, and then discarded. Such utilized flakes are made by all peoples using stone tools. However, the combination of technique applied to the flakes in this collection and the kind of stone employed suggests a specialized, and probably earlier, industry. The reason for this observation is a combination of subjective judgment and circumstantial evidence. There is a quality to the retouching which is not seen in the Archaic stage cultures. Also these utilized flakes are small and delicate and they were either hafted in a manner which protected them, or they were not used for rough work. This is not characteristic of the stonework of the Archaic and later stage peoples.

The techniques identified on the utilized flakes are pressure retouching and "shearing" which is a specialized form of pressure retouching. Tools in a third group were probably chipped by use. Simple pressure retouching produces an edge by separate and repeated movements of the tool which presses off the flakes. Removal of large flakes results in coarse and rough edges. Expert artisans can remove very small chips producing a smooth and sharp edge which when inspected closely is serrated, that is, the points between the chips are not removed. Most of the workmanship on pressure retouched utilized flakes in this collection is of high quality.

The technique of shearing was first described by Barbieri (1937: 106):

> Some material, notably obsidian, flakes into very thin, fragile edges. Such edges develop in other materials during the process of pressing off thin flakes. They have not sufficient solidarity to carry the force of the flaking tool down into the material far enough to produce a sizable flake, but break off short at the slightest pressure. So the workman shears them off by running the side of his flaking tool across the thin edge at an angle nearly parallel with the face of the specimen, pressing firmly as the tool sweeps along the edge. This shears off the useless zone and produces a slightly blunted edge against which the flaking tool can find a proper "bite." . . . the technique may be detected by the minute negative diagonal grooves on the edge. . . .

This technique used only on flakes with a flat face produces edges which are sometimes difficult to distinguish from fine pressure retouched edges. However, examination with a 10x magnifying glass reveals the minute diagonal flakes, regularly spaced, as mentioned above, and also absence of the points between the flake scars; the edge is smooth rather than serrated. Also, subject to some exceptions, sheared edges may be at a steep angle with the flat face from which it was chipped.

There are utilized flakes which have edges modified by use. This produces flake scars scattered along the edge which resemble either shearing or pressure retouching. Chipping of this sort is rarely continuous along an edge for a distance sufficient to make the edge useful for cutting or scraping. Painstaking examination can distinguish naturally chipped and broken edges of thin flakes with a reasonable degree of accuracy. Convex edges on utilized flakes may be retouched for the whole length or for a short section either in the center or at one end which is often the right hand end.

One tool (Fig. 1 *t*) is pressure retouched along the right hand two-thirds of the edge. A second (Fig. 1 *u*) shows the same section of a tool having a sheared edge. The convex edges of two thin chips have been retouched (Fig. 1 *v*, *w*). Irregularities in the first specimen suggest pressure retouching, but the relatively smooth edge of the second may be due to shearing. Two specimens having concave edges have been pressure retouched and this is unusual for most concave edges are sheared (Fig. 1 *x*, *y*).

Two flakes resembling lamellar flakes have a notch chipped into one edge. One (Fig. 1 *z*, obverse, *aa*, reverse) exhibits the notch near the end of the flake. Possibly the flake has been broken so that the upper end of the original notch is not present. The notch has been chipped from the obverse face and the scars appear on the reverse. The second notched flake (Fig. 1 *bb*, *cc*) is very similar except that the upper end is present.

Five specimens illustrating the variation and characteristics of utilized flakes have straight edges. Several (Fig.

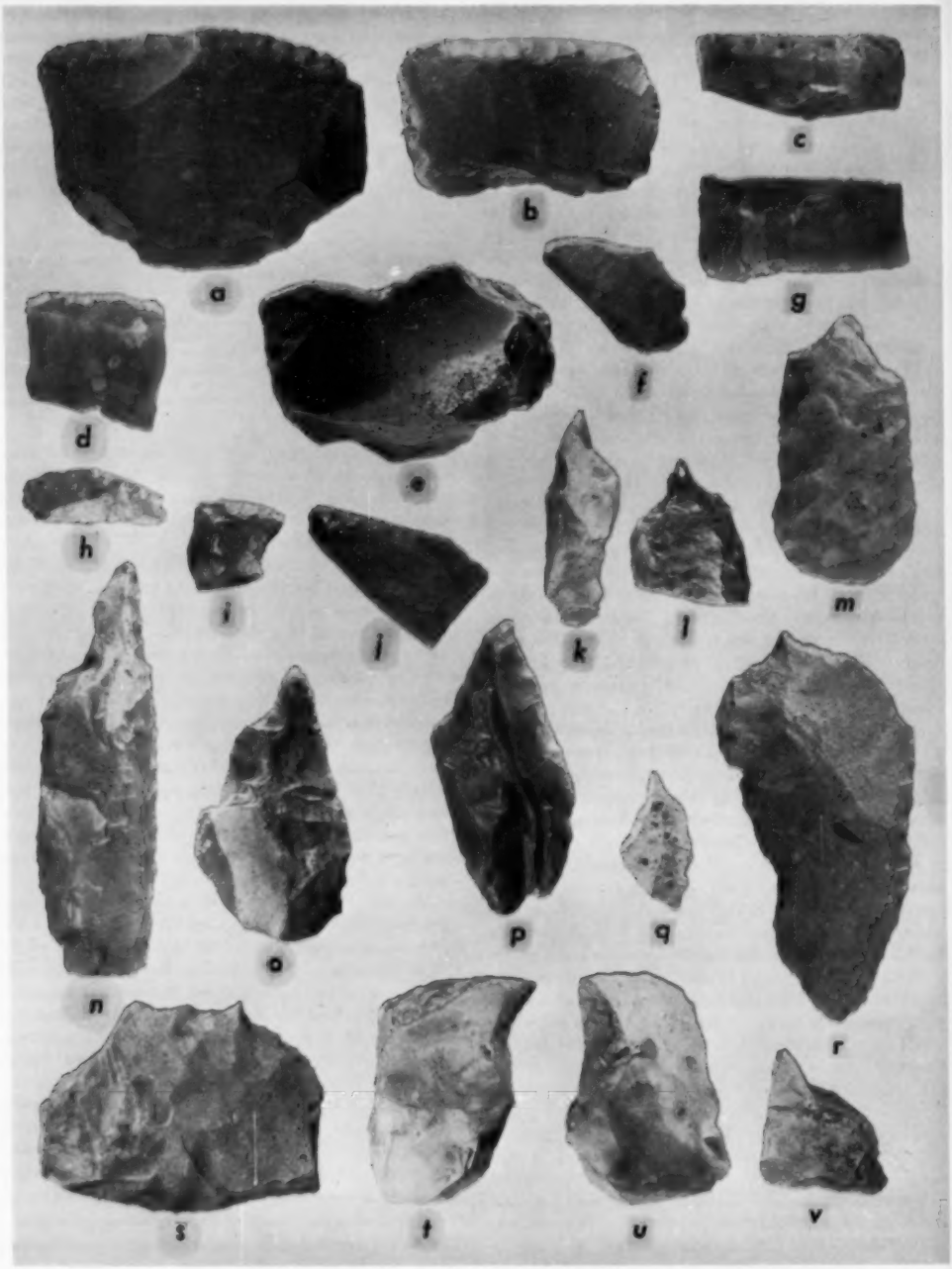

Fig. 2 [Johnson and Neill]. Artifacts from the terrace of the Blanchard River in northwestern Ohio.

2 *a*, *b*) are relatively thick specimens; others (Fig. 2 *c–e*) are thin with sheared edges. The sheared edge of one (Fig. 2 *g*) has been smoothed, perhaps dulled by use.

Figure 2 *e*, *f*, *h–j* further illustrate the range of variation of utilized flakes having sheared edges. Careful inspection will show that only sections of the edges have been retouched and that these may be straight, concave, convex, or a combination.

Gravers are stone tools having a point worked on the end or side of a flat-faced flake. Tools are classified here as gravers regardless of their size because they have all been made in the same way. They could be used for scratching or scoring bone or wood, or for boring shallow holes, usually of small gauge.

One large tool (Fig. 2 *n*) is a thick flake having one flat face which was coarsely chipped into shape. The retouching was done mostly on the convex side shown in the illustration, but there was some attempt at retouching the opposing flat face. The pointed projection was formed by the removal of coarse chips and then its point was carefully retouched. The right hand side of the implement could have been used as a knife or a scraper.

Another flake with one flat face (Fig. 2 *o*) is retouched only on the convex face. The fine chips being restricted to the edges of the projecting point. On the left this extends to the first notch. On the right of the point fine retouching on the edge extends to a location opposite the notch. Below this the right side has been roughly retouched.

A third tool having one flat face is made from a thick flake which probably was selected because it was pointed (Fig. 2 *p*). The actual point has been sharpened by removal of a few small flakes; the right hand edge has been sharpened and probably slightly modified by use. Not showing well in the illustration is a small chip which has been removed from the right hand side of the point. This is not a burin spall but it forms a point which could be used in place of a burin.

A graver point worked on the end of a very small, thin, fragile chip is illustrated in Figure 2 *q*. Graver points may be worked into the edges of large, thin flakes. Other edges of these flakes are frequently retouched, usually by shearing. Figure 2 *s* illustrates a graver point on the uppermost side of the implement. Only sections of the edge immediately adjacent to the point have been retouched. The lower side has been sheared. Graver points also have been formed on ends of flakes. On one such specimen (Fig. 2 *r*) retouching by shearing extends about $\frac{1}{16}$ inch on each side of the graver point. A shallow concavity has been chipped into the lower middle section of the left hand side of the implement. The right hand side has been crudely retouched from the upper shoulder around the lower pointed end but it does not join the retouching of the concavity.

An unusual type of graver has been made of a thick piece of stone which has one flat face (Fig. 2 *t*, obverse, *u*, reverse). Pictures of the artifact were taken at angles so as to show the point retouched on the upper right hand corner. The specimen is sub-triangular in horizontal cross section. A large piece had been broken out of the right hand side leaving a concavity and producing a point on the upper right hand corner. This point has been sharpened by retouching its upper edge and that in the concavity (Fig. 2 *t*). Figure 2 *u* shows the face of the concavity and the chip scars from the retouching of the point. The flat face of the implement lies to the right of the concavity.

A comparable tool (Fig. 2 *v*) is a small block of stone with a flat face which had been broken so as to leave the point on the upper left. A very few small flakes removed from this point could be due to use; they may have been removed in order to sharpen the point. In any case, this is a useful tool.

Three small thin chips have one straight edge which has been sheared (Fig. 3 *a–c*). The characteristic of these tools, is the short retouched section of the right hand upper edge. The left hand portion is not retouched perhaps because these chips were hafted so that the unretouched portion was buried in a socket or groove of a handle.

Three tools appear to be specialized kinds of gravers. They are closely related to burins (Fig. 2 *k–m*). Two of the specimens have been made from chips having one flat face. The third (Fig. 2 *m*) has been made from a knife, but it, too, has one flat face. In each case a relatively large chip has been removed from one side of the upper end of the flake and a blunt, chisel-shaped point was formed by finely retouching the opposite edge. The tools cannot be called burins at least in the American sense because the spalls which here form the point do not produce the characteristic hinge fracture at the base.

Four specimens illustrate types of implements for which there is no accepted American term, as far as we know (Fig. 3 *d–g*). Two specimens (Fig. 3 *d*, *e*) are analogous to certain types of European burins. They are thick, tabular pieces of stone with one pointed or blunted end. The point and the blunted end have been retouched so as to form a point or cutting edge at the intersection with the flat face. In both specimens illustrated, this point or cutting edge has been smoothed presumably by use. The other two specimens (Fig. 3 *f*, *g*) might be called "beaked" scrapers. However, they are closely similar to the specimens just described. These are thick, triangular flakes having one flat face. The blunt point has been formed by vertical chipping. The tools may be triangular in cross section having a median ridge (Fig. 3 *f*) or simply convex without the ridge (Fig. 3 *g*).

An unusual tool was found in the spring of 1960 (Fig. 3 *h*, *i* section of the point greatly enlarged). The tool is made of quartzite which is an unusual material in this collection. The surface is somewhat weathered. Originally, the tool was a triangular knife, but at some time its point was modified after the manner of chipping burins. The scar of one large flake can easily be seen in the illustration. A much smaller second scar ends in a small hinge fracture at about the middle of the large flake. As is true of other tools described, this specimen is not a burin, but it belongs in a category which is very closely allied to that type of tool.

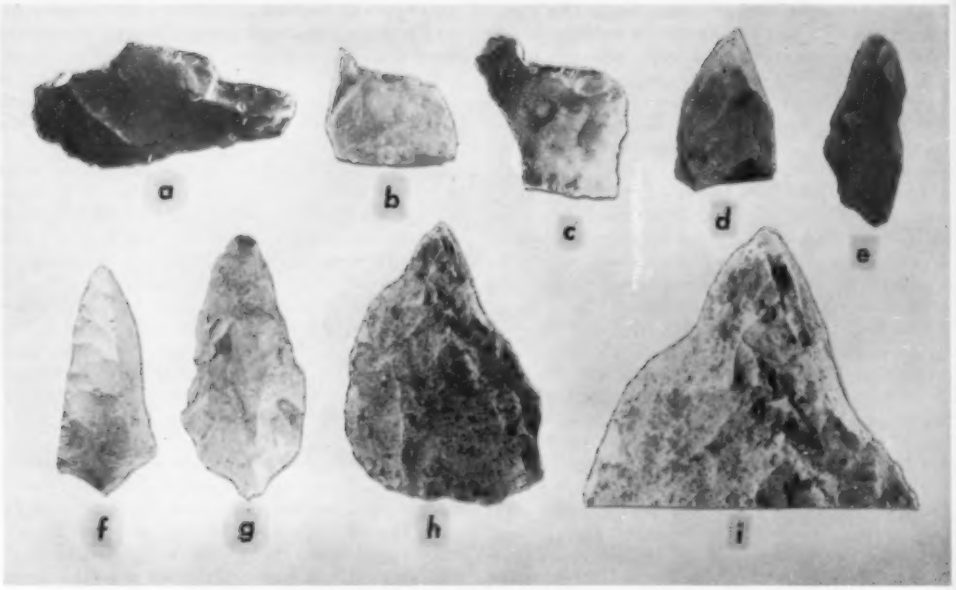

Fig. 3 [Johnson and Neill]. Artifacts from the terrace of the Blanchard River in northwestern Ohio.

The preceding is a more detailed description than is usually provided tools of this category from the Middle West. In themselves the tools are probably not unique in the area. Gravers, for example, are present, though apparently quite rare, in Archaic assemblages, and some of the detailed varieties described here are not reported elsewhere. This lack may be due to insufficient numbers to justify segregation. We have pointed out the existence of tools which we have called gravers, but we have also suggested that these may have been allied to burins, at least in function. At far as we know, we have no precedent for this type of tool in the area. The variety of scrapers and the possible classes of utilized flakes described from Ohio can only be compared with published descriptions of very generalized groups from the Middle West. In other words, there is a decided lack of the comparative material permitting satisfactory placement of the tools from the Blanchard River terrace in any cultural context. There are suggestions that we are dealing with some phase of the Archaic stage. However, the relative number of tools of several types, the kind of stone employed, and the techniques of stone-working are not characteristic of phases of the Archaic stage. This leads to the considerable possibility that the material originated in a preceding stage, or, shall we suggest, is transitional between paleo-Indian, or a phase of the Lithic stage, and the Archaic. This estimate is most hypothetical; grounds for it are exceedingly tenuous. The principal contribution of this paper is the location and primary description of the stone tools which have been saved from oblivion by Neill's intelligent collecting.

Barbieri, Joseph
1937 Technique of implements from Lake Mohave. In "The Archaeology of Pleistocene Lake Mohave: A Symposium," by E. W. C. Campbell and others, pp. 99-107. *Southwest Museum Papers*, No. 11. Los Angeles.

Byers, D. S.
1954 Bull Brook — A Fluted Point Site in Ipswich, Massachusetts. *American Antiquity*, Vol. 19, No. 4, pp. 343-51. Salt Lake City.

Ritchie, W. A.
1953 A Probable Paleo-Indian Site in Vermont. *American Antiquity*, Vol. 18, No. 3, pp. 249-58. Salt Lake City.

Witthoft, John
1952 A Paleo-Indian Site in Eastern Pennsylvania: An Early Hunting Culture. *Proceedings of The American Philosophical Society*, Vol. 96, No. 4, pp. 464-95. Philadelphia.

R. S. Peabody Foundation
Andover, Mass.
Ottawa, Ohio
April, 1960

CORD MARKING VERSUS FABRIC IMPRESSING OF WOODLAND POTTERY

George I. Quimby

Abstract

In some instances it is very difficult to distinguish between cord-impressed and fabric-impressed surfaces on aboriginal pottery. This problem is discussed with particular reference to a protohistoric Woodland jar from western Michigan. It is suggested that fabric impressing and cord marking are closely related techniques which stem from the same cultural tradition.

SOME YEARS AGO I stated that I could not distinguish between some pottery impressions made with closely woven twined fabric and those made with a paddle closely wrapped with cord (Quimby 1947: 175). At a later date Tolstoy (1953: 26) claimed that "this must be considered an overstatement, since most archaeologists working in the eastern United States seem to make the distinction quite confidently." What I should have added to my original statement was that I had undertaken the following experiment. Out of bast fiber cord obtained from Ottawa Indians I had made a 3-inch square rectangle of closely twined fabric. I also wrapped a 3-inch wooden paddle with bast fiber cord closely spaced. I then made impressions in soft modeling clay using the twined fabric and the cord-wrapped paddle, and was unable to tell from observation of the impressions which one was twined fabric and which was cord-wrapped paddle.

Recently I have come up against the same kind of problem in connection with a jar of fired clay found with a burial at a protohistoric Woodland site in western Michigan (Fig. 1). The site is considered to be protohistoric because of the lack of trade goods and the excellent degree of preservation of ordinarily perishable items such as human flesh and muscle; human hair ornamented with copper hair pipes and shell beads; textile fragments, seeds of pumpkin (*Cucurbita pepo*) and wild grape; and skin and hair of black bear, elk, raccoon, and beaver.

The pottery, associated not only with the items mentioned above, but also with triangular projectile points of chipped flint, stone celts, clay elbow pipes, elliptical scrapers of flint, copper beads, shell beads, and other traits, is a part of the tribal culture of some Algonkian-speaking groups of Indians who were in the region shortly before the arrival of Europeans.

The pottery jar in question is 20.5 cm. high with a maximum body diameter of 21 cm. and a mouth that is 18.5 cm. in diameter. The thickness of the rim is 9 mm. and the thickness of the body at the line of maximum diameter is 5 mm. The paste is soft with a hardness of 2 to 2.5 and the rather abundant tempering consists of small to medium particles of granite rock. The color of this jar is tan and gray except in areas that are smoke blackened.

The top of the rim is scalloped. The directions and positions of minute striations and eversions indicate that the scalloping was done by the potter's fingers, and the lip reshaped to more or less uniform thickness subsequent to the scalloping.

The entire exterior vessel surface is covered by impressions of what at first glance seems to have been a cord-wrapped paddle, but what on closer inspection appears to have been a fabric-wrapped object used while the clay was still plastic.

To test this last observation I made a rubber mold that extended from base to lip and encircled nearly one half

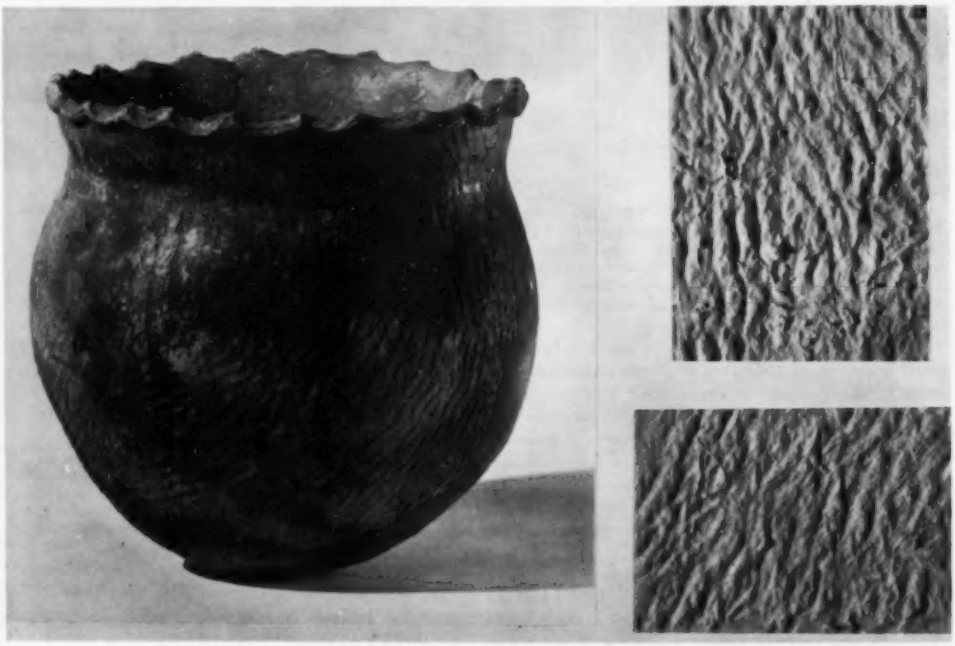

FIG. 1 [Quimby]. Protohistoric Woodland jar with fabric-impressed surface (left) and rubber molds showing kind of fabric used in making the impressions (right).

of the vessel. The rubber mold would, of course, provide a positive impression of at least a part of the object used to make negative impressions on the surface of the jar. An examination of the positive impression in the rubber mold suggests a coarse, tightly woven fabric or possibly a piece of basketry (Fig. 1). The weaving technique is difficult to identify because only a part of the weave is registered in the impression, but it seems to be twining. My colleagues, Donald Collier and John Rinaldo, concur in this opinion. See Rachlin (1955) for details of the rubber mold technique.

Other pottery from the same site seems to have been marked with a cord-wrapped paddle, so I assume that fabric impressing and cord marking are closely related techniques and part of the same cultural tradition. However, I can only conclude that I still cannot tell with certainty the difference between some kinds of cord marking and some kinds of fabric impressing.

Quimby, G. I.
1947 The Prehistory of Kamchatka. *American Antiquity*, Vol. 12, No. 3, pp. 173–79. Menasha.

Rachlin, C. K.
1955 The Rubber Mold Technic for the Study of Textile-Impressed Pottery. *American Antiquity*, Vol. 20, No. 4, pp. 394–6. Salt Lake City.

Tolstoy, Paul
1953 Some Amerasian Pottery Traits in North Asian Prehistory. *American Antiquity*, Vol. 19, No. 1, pp. 25–39. Salt Lake City.

Chicago Natural History Museum
Chicago, Ill.
July, 1960

FLUTED POINTS IN PARIS

Philip E. L. Smith

Abstract

The Vesignié collection of North American stone artifacts, at the Institut de Paléontologie Humaine in Paris, contains a number of fluted points from Illinois, Kentucky, Missouri, Arkansas, Tennessee, Ohio, and Indiana. Most of these points seem to fit in the Clovis category, with a few Cumberland and Enterline-like examples.

THE INSTITUT de Paléontologie Humaine in Paris possesses a very large collection of North American stone artifacts, the gift of the late Colonel L. Vesignié. A former president of the Société Préhistorique Française, he spent considerable sums of money over a period of several decades in bringing specimens of American aboriginal stone working to France. At his death in 1954, most of them were bequeathed to the Institut. The collection consists of many thousands of items, with a great number of choice pieces in polished stone, and well merits the attention of New World archaeologists.

While I was working at the Institut in 1959, I had the opportunity to inspect the entire collection. Among the chipped stone artifacts were a number of fluted points which are the subject of the present note (Figs. 1, 2). It is most unfortunate that the cataloging of the Vesignié collection was never fully carried out, and, except for the labels on the artifacts themselves, the only information now available is that given in a rather incomplete ledger-catalogue kept by Vesignié and held in the Institut. The proveniences of the items are sometimes vague, and in many cases the sites involved are not indicated by name. Of the fluted points, four are from Illinois, three from Kentucky, and there is one from each of the states of Missouri, Montana, Arkansas, Tennessee, Ohio and Indiana. In addition, two are described only as U.S.A., and I was unable to locate a fifth point from Illinois. It would seem, from the references to prices paid for several of the artifacts, that they were purchased directly from the local collectors rather than through commercial antiquity dealers in France.

It is obvious that, under these circumstances, the archaeological usefulness of the collection is greatly reduced. Nevertheless, it seemed to me that an illustrated note about the fluted points might have some interest to American archaeologists, if only from a distributional viewpoint.

It should be pointed out that five of the points which had been collected by Vesignié were catalogued in the collection under a single number (1797 Rc). All were bought from Lomley, Northbranch, Kansas, in April, 1937. They are described in the catalogue as "*5 pointes de Folsom, 4 en silex, 1 en jaspe.*" Of these, three are listed with only U.S.A. for provenience, and of these three, one is now missing from the collection. Another of the five, described as coming from Pike County, Illinois, is also missing. The remaining three I have designated in this note by adding the letters A, B, and C to the original catalogue numbers.

Vesignié had intended to publish this collection of fluted points himself but never did so. Except for a short paragraph referring to them in the *Bulletin de la Société Préhistorique Française* (Vesignié 1937), they seem never to have been mentioned in the literature. Two of the points illustrated here (Fig. 1 *b* and Fig. 2 *f*) are now in the possession of François Bordes of the Laboratoire de Préhistoire, Université de Bordeaux. They were given to him by Vesignié, and I thank Bordes for allowing me to publish them here and for telling me about the collection in the first place. I am grateful to Raymond Vaufrey, Institut de Paléontologie Humaine, who gave me permission to study the artifacts and to publish this selection.

Description of the Points

Catalogue No. 99 Rc. Boone County, Missouri. Cream-colored flint, with grinding of the basal concavity. Maximum length 8.5 cm., max. width 2.5 cm., max. thickness 9 mm. Possibly a Clovis point (Fig. 1 *a*).

Cat. No. 1571 Rc. Tennessee. Gray flint. No basal grinding, but some steep retouch at the base of the flute. Fine, even side-flaking, probably done after the flute was removed, at least in part. Max. length 7.5 cm., max. width 2.2 cm., max. thickness 7 mm. Now owned by F. Bordes. This specimen is perhaps a Cumberland point (Fig. 1 *b*).

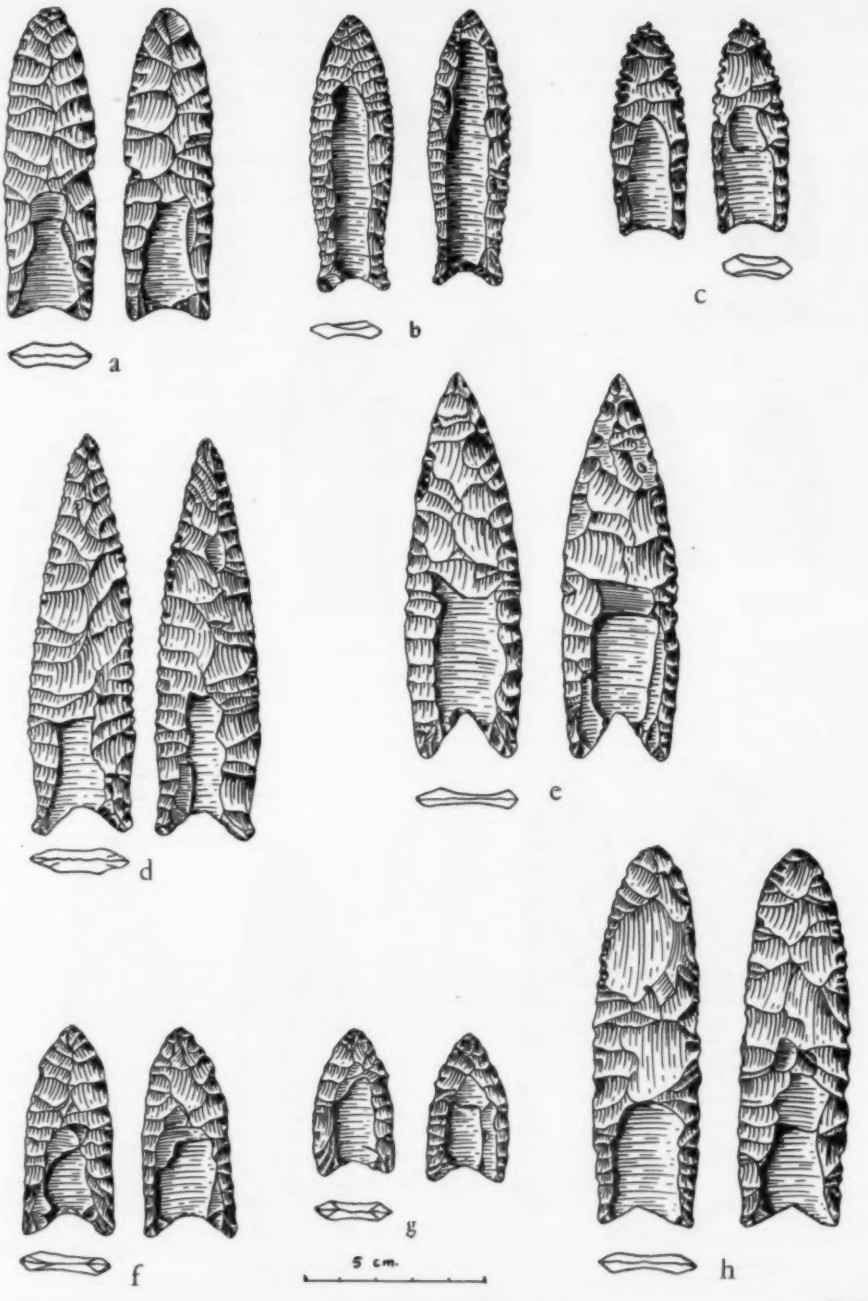

FIG. 1 [Smith]. Fluted points in the Vesignié Collection, Institut de Paléontologie Humaine, Paris.

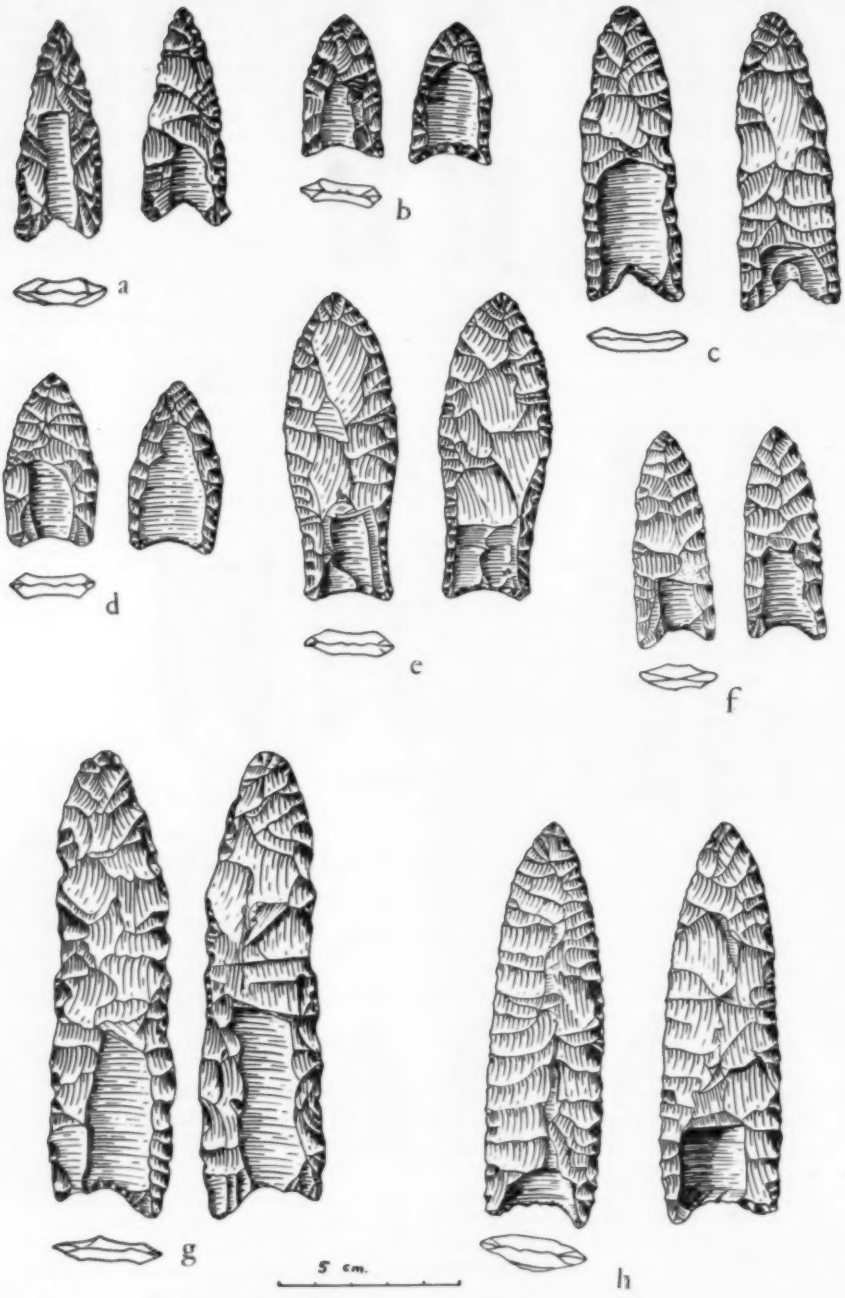

Fig. 2 [Smith]. Fluted points in the Vesignié Collection, Institut de Paléontologie Humaine, Paris.

Cat. No. 1550 Rc. Montana. Made of white flint, with no basal grinding. Denticulated (possibly by later work) near the tip. Max. length 5.5 cm., max. width 2.1 cm., max. thickness 7 mm. Possibly an atypical Clovis point, though rather small (Fig. 1 *c*).

Cat. No. 1660 Rc. Provenience not given. Cream-colored flint. Grinding of the basal concavity and of the sides near the base. Probably some pressure-retouch along the edges. Rather small flutes. Max. length 10.8 cm., max. width 2.9 cm., max. thickness 9 mm. (Fig. 1 *d*).

Cat. No. 1572 Rc. Joliet (?), Illinois. Fine-grained veined gray flint. Ground basal concavity and several areas of grinding on one face near the tip. Max. length 10.5 cm., max. width 3.2 cm., max. thickness 7.5 mm. Possibly a poor Clovis with later retouching and grinding (Fig. 1 *e*).

Cat. No. 1556 Rc(?). Kentucky. Fine-grained light gray flint with grinding of the basal concavity. One of the flutes shows irregularity due to removal by several successive blows. Max. length 5.7 cm., max. width 2.5 cm., max. thickness 7 mm. Clovis-like (Fig. 1 *f*).

Cat. No. 1575 Rc(?). Scioto County, Ohio. Fine-grained gray flint, with grinding of the basal concavity and side-grinding near the base. Max. length 4.0 cm., max. width 2.1 cm., max. thickness 5 mm. Clovis-like (Fig. 1 *g*).

Cat. No. 1570 Rc. Lula, Kentucky. Brown flint. Grinding in the basal concavity, and apparently some side-grinding especially near the tip. Rather heavy percussion flaking, with possibly a little pressure flaking. Max. length 10.3 cm., max. width 3.0 cm., max. thickness 8 mm. Possibly a Clovis point (Fig. 1 *h*).

Cat. No. 1551 Rc. Arkansas. Dark brownish-gray flint. Thick section, rather irregular flaking and asymmetrical ears. No basal or side grinding. Max. length 5.9 cm., max. width 2.4 cm., max. thickness 1.7 cm. (Fig. 2 *a*).

Cat. No. 1797 Rc B. Provenience given only as U.S.A. White flint. Grinding in the basal concavity and along the shanks. Max. length 3.9 cm., max. width 2.1 cm., max. thickness 6 mm. This point resembles some found at Enterline (Fig. 2 *b*).

Cat. No. 1573 Rc. Illinois. Fine-grained creamish-white flint. Basal concavity grinding and possibly some side grinding. Max. length 8.2 cm., max. width 2.5 cm., max. thickness 1.7 cm. (Fig. 2 *c*).

Cat. No. 1797 Rc A. U.S.A. White flint. Basal concavity grinding and some side grinding. Max. length 4.7 cm., max. width 2.5 cm., max. thickness 7 mm. (Fig. 2 *d*).

Cat. No. 1658 Rc. Indiana. Light brown flint. Even, regular flaking with possibly some pressure flaking at the sides. Basal concavity grinding and some side grinding near the base. Max. length 8.3 cm., max. width 3.0 cm., max. thickness 8 mm. Possibly a Cumberland point with secondary retouch (Fig. 2 *e*).

Cat. No. 1797 Rc C. Hancock County, Illinois. Brown jasper. Rather irregular flaking and fluting. Basal concavity grinding. Flute removed after the side and tip flaking. Max. length 5.7 cm., max. width 2.1 cm., max. thickness 6 mm. Now owned by F. Bordes. Probably a Clovis point (Fig. 2 *f*).

Cat. No. 1974 Rc. Kentucky. Brown flint, with very rough irregular flaking and crude fluting. Basal concavity grinding. Max. length 12.8 cm., max. width 3.4 cm., max. thickness 9 mm. (Fig. 2 *g*).

Cat. No. 1659 Rc. Fulton County, Illinois. Cream-colored flint. Even, regular flaking, though the flute on one side is not well defined. Some slight basal concavity grinding. Max. length 11.0 cm., max. width 3.3 cm., max. thickness 9 mm. Possibly a poor Clovis point (Fig. 2 *h*).

VESIGNIÉ, L.
1937 Les Pointes de Folsom. *Bulletin de la Société Préhistorique Française*, Vol. 34, No. 7–8, p. 150. Paris.

UNIVERSITY OF TORONTO
Toronto, Canada
July, 1960

THE USE OF THE TERM "MIXTEC" IN MESOAMERICAN ARCHAEOLOGY

H. B. NICHOLSON

ABSTRACT

Vaillant's geographic and stylistic term, Mixteca-Puebla, is rapidly and unfortunately being supplanted by an ethnic and linguistic term, Mixtec, which has rather suddenly become a popular label for the final pictorial horizon style of much of Mesoamerica. The well-known dangers of using an ethnic or linguistic term for an archaeological manifestation are intensified in this case by the lack of systematic archaeological work in the Mixteca region. The great mercantile and religious center of Nahua-speakers rather than Mixtec-speakers at Cholula is suggested as the origin of the almost pan-Mesoamerican diffusion of the Mixteca-Puebla style in Postclassic times. Thus, Mixteca-Puebla, not Mixtec, should be used to describe this style which flourished in and probably originated somewhere in a geographic region dominated in late preconquest times by Nahua-speakers in the north and Mixtec-speakers in the south.

ALTHOUGH DISPUTES OVER terminological niceties often futilely consume time which could be more profitably spent on productive research, occasionally it is worthwhile examining certain labels whose use might lead to significant culture-historical errors. Such a case, I believe, has recently developed in Mesoamerican studies with the rather sudden popularization of the term "Mixtec" as a broad generic label for the final pictorial horizon style of much of Mesoamerica. Typical examples of a much more inclusive use of this term than was formerly common are encountered in the recent books of Covarrubias (1957) and Robertson (1959) and in two articles by Franco (1958, 1959).

Covarrubias (1957) devoted an entire chapter (9) to the "Mixtec" esthetic achievement, in which he stretches this term to cover a stylistic movement much broader than that which can be localized in that portion of west-

ern Oaxaca occupied by Mixtec speakers in late prehispanic times. He first speaks of a new "culture" centered in Puebla and the Mixteca arising at the opening of the Historical Period (=Postclassic), and recognizes the aptness of the Vaillant label, Mixteca-Puebla. However, he immediately proceeds, "for the sake of simplification," to drop the word Puebla and from that point on employs "Mixtec" alone (although frequently using Mixteca-Puebla in a standard fashion in other parts of the book). He is actually doing more than just dropping one half of a two-word label; he is replacing a geographic term, Mixteca, with an ethnic-linguistic one, Mixtec.* His subsequent use of Mixtec is sufficiently broad that it includes everything from Aztec I ceramics and "the famous Mixtec polychrome pottery" of Cholula to the Borgia group of codices, "fully identified as Mixtec." Robertson (1959: 7–11) takes a similar approach, recognizing a "Mixtec School" of manuscript painting, which would subsume the styles of the Borgia codex group. In the same vein, Franco (1958: 14) has characterized an object decorated in a style virtually identical to the Mexica Calendar Stone as "Mixtec," and expressed the view that "Aztec" (that is, Valley of Mexico-centered) style is an almost 100% Mixtec derivative (Franco 1959: 376–8).

I have previously objected to Covarrubias' over-generic use of "Mixtec" (Nicholson 1958); in this brief note I would like to further buttress my case. First of all, it has often been recognized that ethnic-linguistic terms for art styles can easily lead to considerable culture-historical confusion and error. Perhaps the classic case in Mesoamerica is the use of "Tarascan" for nearly all western Mexican archaeological pieces. It is now clear (for example, Toscano 1946; Covarrubias 1957: 85) that the Tarascan speakers probably had nothing whatever to do with the best known and most spectacular styles of this extensive region (such as Ixtlán del Río, Ameca-Zacoalco, Colima). The use of "Totonac" for the double-outlined, interlocking-scroll, yoke-hacha-palma style (the Classic Veracruz style of Proskouriakoff 1954) is another example of the unfortunate choice of a linguistic term for an art style in whose development the Totonac speakers may or may not have played a significant role. The confusions caused by the use of ethnic terms for styles is particularly well illustrated by the unnecessary problem which arose over the use of Mixtec in the interpretation of the Yagul ceramic assemblage, which I have commented upon elsewhere (Nicholson 1957). Occasionally, of course, ethnic-linguistic terms for styles may be justified; certainly they frequently become so entrenched (for example, Maya) that their discarding would generate more problems than their continued use. Generally, however, geographical terms are to be preferred as labels for styles, since it probably was the exception rather than the rule in Mesoamerica for art styles to be completely restricted to a single ethnic-linguistic group.

In the case under discussion, a known term derived from geographical designations has been in use for many years: Mixteca-Puebla. I have recently re-examined the Mixteca-Puebla concept in Mesoamerican archaeology, and have attempted to define it with more precision and to delimit some of the leading sub-styles. Although as a label Mixteca-Puebla is slightly more awkward than Mixtec, it is so much more accurate geographically and, probably, culture-historically, that it should not be discarded in favor of the shorter term without strong reason. Certainly, the inclusion of Puebla in the term is very much in order. Although the precise origins of the Mixteca-Puebla style configuration are still obscure, on the basis of present evidence (Nicholson 1960), during the Classic-Postclassic transition and all through the Postclassic, Cholula and the southern Pueblan area may well have played the key role in the development of this vigorous, influential style, which, expressed through various sub-styles, ultimately became the great pictorial horizon style of Mesoamerica in the centuries just preceding the Conquest.

What role the Mixteca proper played in the development of this new stylistic synthesis is particularly obscure. A great gap exists in the archaeological record here between the time of the flourishing of the western Oaxacan variant of the Monte Albán tradition (Yucuñadahui, or Chachoapan=Monte Albán IIIA–IIIB) and the efflorescent terminal Mixteca phase (Tilantongo-Coixtlahuaca, Las Pilitas), precisely the period when the Mixteca-Puebla style was taking form (Caso 1938; Bernal 1948–49). Until this glaring gap is filled by further systematic archaeological work in the Mixteca region, it is probably useless to speculate, but it may turn out that this area was more on the receiving end of stylistic influence from the north than functioning as the major creative center for the development of the Mixteca-Puebla style (compare Noguera 1954: 271–2, 297–300; 1959: 419).

It has sometimes (for example, Paddock 1953: 6–7) been assumed that, because it can be argued that the Mixteca expression of the style was the most complex and exquisite, this area must have been the key creative center. However, on the basis of present evidence it could just as well be argued that the specifically Mixteca sub-style is a particularly intense local specialization out of a more generalized stylistic base, which was centered in an area not far to the north. Certainly the great mercantile-religious mecca role of Cholula would seem particularly well-designed to promote the almost pan-Mesoamerican diffusion of the Mixteca-Puebla style in Postclassic times. The more localistically oriented Mixteca centers, notwithstanding the characteristic preciosity of their artistic creations, were hardly in a position to function nearly as effectively as sources of widespread cultural influence as cosmopolitan Cholula, teeming with pilgrims and merchants from all over central-southern Mexico. The widespread merchandizing of the elaborately decorated Cholulteca polychrome ware, especially noted by the conquistadores (for example, Oviedo 1946: 16; Gómara 1943: 199; Díaz del Castillo 1955: 173), might in itself go a long way to explain the great penetration of

* Although originally an ethnic-linguistic term, since the early colonial period, Mixteca has been applied to the *area* dominated by the Mixtec-speakers (originally Mixtecapan or Mixtecatlalli). In modern Spanish usage, the ethnic-linguistic term is usually *mixteco*, while the region is called La Mixteca.

Mixteca-Puebla stylistic influence in Postclassic Mesoamerica.

Regarding the matter of artistic excellence, anyone who has perused a typical collection of the finest Cholulteca polychrome vessels (see illustrations in Noguera 1954) or carefully scanned the coloristically brilliant and pictorially complex pages of the Codex Borgia — which I am convinced (Nicholson 1960) was probably produced in Cholula itself — can hardly deny that the Nahua-speaking craftsmen of the great Pueblan urban commercial mart clearly equalled the undeniable superb artistic skill of their Mixtec-speaking cultural cousins to the south. The term Cholulteca, therefore, could be used for this style, in its broadest connotation, with as much, perhaps more, justification as Mixtec. Caso (1953: 21), on the other hand, has consistently employed the more generic term, "Poblano-Tlaxcalteca."

The term Mixtec has an undoubted validity for that sub-style within the larger Mixteca-Puebla tradition which flourished in western Oaxaca during the Postclassic, although the geographical term, Mixteca, would be preferable since it appears virtually certain that this basic style was not entirely confined to the Mixtec–speaking towns. The hybrid Chocho-Mixtec of the Coixtlahuaca region, for example, judging from the Lienzo de Coixtlahuaca, shared a virtually identical style, as did the late preconquest Zapotec-speakers of the Valley of Oaxaca (witness the style of the Mitla wall paintings), not to mention the closely related style of the codices Fernández Leal and Porfirio Díaz, assigned to the Cuicatec-speaking region of northern Oaxaca.

To conclude, I would urge a more restricted use of the term Mixtec than is currently being employed in certain quarters, in the interest of both greater culture-historical accuracy and terminological precision. There is danger of a kind of "pan-Mixtec" school taking form, which would probably only obscure the essential facts of the dynamics of the culture-historical process in late Classic and Postclassic Mesoamerica. It may, of course, turn out, after further archaeological investigation, that the Mixtec-speakers were primarily responsible for the creation and spread of this striking pictorial style, but this cannot be demonstrated in the state of our present inadequate knowledge of the archaeology of this region. It would seem more prudent, therefore, to employ a term such as Mixteca-Puebla, which has the advantage of being already conveniently at hand, and has been part of standard usage in Mesoamerican archaeology for years. Above all, Mixteca-Puebla is not tied to any particular ethnic-linguistic group. Rather, as such stylistic terms should, it describes the geographical area (dominated in late prehispanic times by Nahua-speakers in the north and Mixtec-speakers in the south) where this style undeniably flourished with greatest intensity and within whose boundaries it probably originated.

Bernal, Ignacio
1948–49 Exploraciones en Coixtlahuaca, Oaxaca. *Revista Mexicana de Estudios Antropológicos*, Vol. 10, pp. 5–76. Mexico.

Caso, Alfonso
1938 Exploraciones en Oaxaca, quinta y sexta temporadas, 1936–1937. *Instituto Panamericano de Geografía e Historia, Publicación*, No. 34. Tacubaya.
1953 *El Pueblo del Sol*. Fondo de Cultura Económica, Mexico.

Covarrubias, Miguel
1957 *Indian Art of Mexico and Central America*. Knopf, New York.

Díaz del Castillo, Bernal
1955 *Historia verdadera de la conquista de la Nueva España*. Colección Austral, Espasa-Calpe Argentina, Buenos Aires.

Franco, J. L.
1958 Un oyohualli Mixteco. *Boletín del Centro de Investigaciones Antropológicas de México*, No. 5, pp. 13–15. Mexico.
1959 La escritura y los códices. *Esplendor del México Antiguo*, Vol. 1, pp. 361–78. Mexico.

Gómara, Francisco López de
1943 *Historia de la conquista de México*. Editorial Pedro Robredo, Mexico.

Nicholson, H. B.
1957 Review of "Excavations at Yagul, I," by John Paddock and others. *American Antiquity*, Vol. 23, No. 2, pp. 195–6. Salt Lake City.
1958 Review of "Indian Art of Mexico and Central America," by Miguel Covarrubias. *American Anthropologist*, Vol. 60, No. 4, pp. 784–5. Menasha.
1960 The Mixteca-Puebla Concept in Mesoamerican Archeology: A Re-examination. *Selected Papers of the Fifth International Congress of Anthropological and Ethnological Sciences* [Philadelphia, 1956], edited under the chairmanship of Anthony F. C. Wallace, pp. 612–7. University of Pennsylvania Press, Philadelphia.

Noguera, Eduardo
1954 *La cerámica arqueológica de Cholula*. Editorial Guarania, Mexico.
1959 Cerámica y estratigrafía. *Esplendor del México Antiguo*, Vol. 1, pp. 411–38. Mexico.

Oviedo, Gonzalo Fernández de
1946 Sucesos y diálogo de la Nueva España. *Biblioteca del Estudiante Universitario*, No. 62. Universidad Nacional Autónoma de México, Mexico.

Paddock, John (editor)
1953 Excavations in the Mixteca Alta. *Mesoamerican Notes*, No. 3. Mexico City College, Mexico.

Proskouriakoff, Tatiana
1954 Varieties of Classic Central Veracruz Sculpture. *Contributions to American Anthropology and History*, No. 58, *Carnegie Institution of Washington, Publication* 606, pp. 61–121. Washington.

Robertson, Donald
1959 Mexican Manuscript Painting of the Early Colonial Period: The Metropolitan Schools. *Yale Historical Publications, History of Art*, Vol. 12. Yale University Press, New Haven.

Toscano, Salvador
1946 El arte y la historia del Occidente en México. *Arte Precolombino del Occidente de México*, pp. 9–33. Secretaría de Educación Pública, Mexico.

University of California
Los Angeles, Calif.

May, 1960

A STATISTICAL DEVICE FOR COMPARING TRAIT LISTS

Y. T. Witherspoon

Abstract

A comparison of Adena and Hopewell trait lists by a correlation scatterplot based on the Q technique is offered as an illustration of the use of a descriptive statistic to

Table 1. Correlation Scatterplot of Adena and Hopewell Traits

	Hopewell					
	Not present	Trace	Moderate	Frequent	Predominant	Number
Adena						
Predominant	1		4	8	12	25
Frequent	6	1	15	19	2	43
Moderate	3	2	14	2	2	23
Trace		8	2	4	5	19
Not present			3	5	2	10
Number	10	11	38	38	23	120

Correlation coefficient: r=.13

reduce the degree of similarity between two cultures to an index which defines a point on a dissimilarity-similarity continuum.

THE PURPOSE of this paper is to demonstrate the contribution which the use of a descriptive statistic can make to the examination of the relationship between two cultures, in this case, Adena and Hopewell cultures. The descriptive materials used are the trait lists published by Webb and Snow (1945) and Webb and Baby (1957). Narrative descriptions of the two cultures are in Cole and Deuel (1937), Deuel (1952), Griffin (1952), Martin, Quimby, and Collier (1947), Spaulding (1952), Webb and Snow (1945), and Webb and Baby (1957). The correlation scatterplot in Table 1 was made from the trait list in Webb and Snow (1945: 153–6). No effort has been made to include materials discovered since the publication of this list.

It is obvious that the data being subjected to analysis are different than those which are ordinarily found in traditional correlation studies. In the usual situation, the performance of a number of individuals is measured across one variable, as in psychological studies where a test is administered to two matched groups, or to one group at two different times. These examples are quite different from the present case where a number of tests have been applied to two individuals (that is, cultures). The use of the correlation technique in this situation is based upon the Q technique developed by Stephenson (1953) wherein one person is given a large number of test items, with each item being regarded as a separate test. The same items are given to the same person at a later time, or to another person at the same time, and the performances correlated. The central difference is that in the traditional situation, one measure is applied to a large number of people, where in the Q situation, a large number of measures are applied to one person.

The correlation coefficient which is derived in the manner demonstrated and in the present context is most usefully interpreted as a descriptive statistic. It provides an index of the similarity or dissimilarity between the two cultures. The range of possible coefficients is from −1.00 to +1.00. The −1.00 represents that end of the continuum which may be best characterized as representing the greatest possible dissimilarity. The +1.00 represents the other end of the continuum which may be described as representing the greatest possible similarity between the two cultures. The 0.00 may be regarded as representing the midpoint of the continuum.

At the −1.00 end of the continuum, those traits that are predominant in one culture would be absent in the other, the traits frequent in one would be present as a trace in the other, and only those present to a moderate degree in both cultures (in this case 14 traits) would be congruent. At the +1.00 end of the continuum, all of the traits would be congruent, that is, all traits predominant in one would be predominant in the other, all traits present to a frequent degree in one would be present to a frequent degree in the other, and so forth.

At the midpoint of the continuum, represented by a coefficient of 0.00, an indeterminant but significant number of traits would be congruent, that is, present to the same degree in both cultures. An actual count of the cells of the scatterplot demonstrates that this is indeed the case and that 53 out of the 120 items are congruent. Thus, the approximate midpoint of the continuum as here represented by a correlation coefficient of .13, adequately reflects the presence of 53 cultural traits which are congruent and equally as adequately represents the 67 cultural traits which are not congruent.

Such a coefficient seems to cast doubt upon the almost unanimous agreement of other investigators who have explored the two cultures that they are, in fact, very closely related if not simply regional and time variations of the same culture. Part of the explanation for attributing less similarity to the two cultures than has previously been assigned to them lies in the fact that a very different frame of reference is used in this statistical analysis. In the traditional approach it is accepted that some traits are more diagnostic of relationship than others, with the decision as to which are the most important traits left largely up to the investigator. In addition, the presence and absence of traits may or may not be regarded as important, since it can be postulated either that the trait in question came earlier or later in the developmental sequence, or simply that the trait is present but has not as yet been discovered.

In the statistical frame of reference, the above assumptions are reversed and can be stated as follows:

1. The analysis deals with only one point in time. There are no judgments made as to whether the trait might or might not be found at some other point in time.

2. The presence or absence of one trait is as important as the presence or absence of another. No trait contributes more weight to the final correlation coefficient than another.

3. The degree to which a trait is present is just as important as the absence or presence of the trait.

4. The use of the correlation technique allows the consideration of all of the 120 traits at one time. This is impossible without the use of statistics, since it is impossible for a person to consider more than three or perhaps four things at any one time. Without the help of a mathematical system, the investigator is reduced to the matching of traits with some sort of subjective summing up as the final product.

The value in the use of a descriptive statistic such as the one illustrated here lies not only in the fact that all 120 traits may be considered at one time, but equally as important is the fact that any investigator can use this method of calculation of the degree of similarity, or dissimilarity, as the case may be, and arrive at the same index as any other investigator. The ultimate interpretation of indexes so derived will depend upon further research since all correlation coefficients must be interpreted in context. It can, however, be stated at the present time that on a continuum from the greatest possible dissimilarity to the greatest possible similarity, the correlation coefficient of .13 derived here falls slightly on the positive side of the midpoint leading us to anticipate (as has been demonstrated to be true) that a significant number of the cultural traits will be congruent for both cultures.

It would be of great value in the analysis of the relationships of the various cultural manifestations within regions if something like the following system could be carried out. First, a trait list should be developed that embodies all of the cultural traits found within the region under study; second, the degree of presence of each trait within each sub-area could be determined, perhaps through the use of percentages as has already been done in certain cases; third, the statistical relationships could be determined by use of the technique demonstrated in this paper; fourth, this process could be repeated for differing time levels; and fifth, the relationships so derived could be plotted geographically. With the body of data derived from the above process, both relationships within the area at one point in time, and developmental sequences through time could be objectively described. Cultures become more alike as the coefficient increases from –1.00 to 1.00, and they are less alike as it decreases from 1.00 to –1.00.

Analysis of the relationship between Adena and Hopewell demands certain further information. A major consideration obviously is that of time or sequence. What time levels are we dealing with and what are the relationships between Adena and Hopewell as far as time is concerned? Webb and Baby (1957: 109–14) present the pertinent information. They conclude on the basis of stratigraphy, typology, and recent radiocarbon dates that (1) Adena is older than Hopewell with a beginning date at least as far back as 1200 B.C. while the earliest date from Hopewell is 600 B.C., and (2) that Adena lasted at least as long as Hopewell with a terminal date around A.D. 900.

Still a further source of information which is essential in considering the Adena-Hopewell relationships is the problem of physical type. It appears incontrovertible at this point that the group exemplified by skeletons taken from Hopewell mounds and those from Adena mounds represent two different groups of people. The Adena people may be classified with some confidence as brachycephalic and correspond to the Gulf type defined by Hrdlička, and the Centralid type as defined by Neumann. The Hopewell people are a long-headed group who fall into the Sylvid classification of the Eastern Woodlands. There appears to be little question that the two groups are readily identifiable as to physical type and that they do represent two different groups.

The above data lend themselves to two diametrically opposed interpretations: (1) the Adena and the Hopewell cultures are in reality only one, and the correlation coefficient of .13 is due to the artificial assignment of complex, exotic traits to Hopewell, and the assignment of less well-developed traits to Adena; and (2) the Adena and the Hopewell cultures are in reality two readily identifiable complexes. The similarity ascribed to the two is the product of looking at those traits that are held in common to the exclusion of differences, to their physical proximity, and to the assumption that Hopewell came later than Adena in time.

The first interpretation involves more difficulties than the second. In order to defend the position that Adena-Hopewell are actually manifestations of the same culture, two primary problems must be resolved. First, why are sites readily identifiable as Adena found throughout the entire area and time span of Hopewell? It appears that if Hopewell is a later developmental phase of Adena, it would have replaced Adena, at least within the restricted area under discussion. This, however, does not seem to be the case. In order to postulate that Adena and Hopewell are actually one cultural sequence, it would be necessary to hypothesize differential rates of development at sites that are quite close together, not only in space but also in time. It would also be necessary to postulate that the less complex of the two was the one that persisted for the longest period of time.

Perhaps an even more fundamental difficulty has to do with the explanation of the difference in physical type. It has already been pointed out that the Hopewell people, or at least those found within the mound burials, are long-headed and slightly taller than the Adena group. The Adena people are round-headed and of medium stature. The two groups are readily distinguishable. The usual explanation for the difference in physical type is that the Hopewell people are intrusive in the area, and that they took over and further developed an already existing Adena culture. Since Adena was contemporaneous with Hopewell, the presence of two different physical types within the one population must be accounted for. The first hypothesis that comes to mind is that the Hopewell people were the ruling class, the leaders in religion and government, and that they did not interbreed with the common people. This hypothesis might be acceptable

for a few centuries, but it seems to be stretching it to try to extend it over a period from 1000 to 1200 years.

The hypothesis that Adena and Hopewell are actually two separate and identifiable cultures seems to fit the data with less strain. In the first place, the coefficient of .13 indicates that if the assumptions listed above are defensible, and it is part of the thesis of this paper that they are, the relationship between the two cultures is only moderate. This is not to deny that there are a number of traits that are present to the same degree in both cultures (a count of the cells on the scatterplot reveals 53 such traits), but it is a fact that the number of traits that are present in both cultures but to a different degree counterbalances the weight of those present to the same degree. Thus when all 120 traits are considered at one time, the correlation coefficient falls at approximately the midpoint on the continuum from most similar to least similar.

In the second place, the differences in physical type appear to be most easily accounted for by assuming the initial presence of the Adena peoples, with the Hopewell people moving into the area at a later time. At the time of initial contact there was clear recognition of differences in both culture and physical appearance. This initial recognition of differences resulted in ethnic barriers that were maintained fairly well over the length of time of contact. The situation suggested here is one analogous to the Hopi-Navajo situation, where the Hopi have been encircled by the Navajo for four centuries, and yet are identified by themselves and even fairly casual observers as different both culturally and physically. This explanation appears to be more easily defended than the assumption that the Hopewell people moved into the area, took over the Adena culture, and not only modified and developed the culture, but finally did away with both the Adena culture and the Adena physical type.

Radiocarbon dates seem to furnish still further proof of these conclusions (Griffin 1958). At any rate, the evidence appears to be clear that the Adena and Hopewell cultures co-existed over the entire time span that may now be credited to Hopewell.

The above data in aggregate are here taken as supporting the following conclusions:

1. The Adena and the Hopewell cultures were distinct entities which are distinguishable wherever found and on any time level.

2. The Adena and the Hopewell cultures were in continuous contact over the total time period that Hopewell was in existence.

3. The cultural and physical differences between the Adena and the Hopewell people constituted a barrier that prevented complete merging, either culturally or biologically.

4. The Adena culture and people were in the Ohio area prior to the Hopewell. The Hopewell group moved in after the Adena culture was established, adopted and developed some of the Adena culture traits, while retaining their physical type and some of their own cultural traits, and then moved out of the area. These developments had some effect upon the Adena culture, but not enough to render Adena unrecognizable even after the Hopewell culture was gone from the area.

5. The use of the descriptive statistic illustrated in this paper reduces the degree of similarity between the two cultures to an index which defines a point on a continuum between maximum dissimilarity and maximum similarity and which may be arrived at in an objective fashion by any interested investigator.

Cole, Fay-Cooper and Thorne Deuel
1937 *Rediscovering Illinois.* University of Chicago Press, Chicago.

Deuel, Thorne (editor)
1952 Hopewellian Communities in Illinois. *Scientific Papers of the Illinois State Museum*, Vol. 5. Springfield.

Griffin, J. B.
1958 The Chronological Position of the Hopewellian Culture in the Eastern United States. *Anthropological Papers, Museum of Anthropology, University of Michigan*, No. 12. Ann Arbor.

Griffin, J. B. (editor)
1952 *Archeology of Eastern United States.* University of Chicago Press, Chicago.

Martin, P. S., G. I. Quimby, and Donald Collier
1947 *Indians Before Columbus.* University of Chicago Press, Chicago.

Spaulding, A. C.
1952 The Origin of the Adena Culture of the Ohio Valley. *Southwestern Journal of Anthropology*, Vol. 8, No. 3, pp. 260-8. Albuquerque.

Stephenson, W.
1953 *The Study of Behavior: Q-Technique and Its Methodology.* University of Chicago Press, Chicago.

Webb, W. S. and R. S. Baby
1957 *The Adena People — No. 2.* Ohio State University Press, Columbus.

Webb, W. S. and C. E. Snow
1945 The Adena People. *University of Kentucky Reports in Anthropology and Archaeology*, Vol. 6. Lexington.

University of Utah
Salt Lake City, Utah
February, 1960

REVIEWS

Edited by Donald Collier

An Archeological Chronology of Venezuela. J. M. Cruxent and Irving Rouse. Social Science Monographs, 6, Pan American Union, Washington. 1958–59. 2 Vols. Vol. 1: xiv+277 pp., 14 tables, $1.00. Vol. 2: ix+223 pp., 201 figs., 104 pls. $1.00.

This study, excellently illustrated by a separate volume containing many figures, charts, maps, and plates, brings together in a chronological framework the large and varied body of information now available on Venezuelan archaeology. Many of the data have been gathered by Cruxent, with the assistance of many Venezuelan scholars and students, in a remarkably effective program of field work initiated in 1942. Both in the field as well as in the analysis of the data Cruxent has had the close collaboration of Rouse who brought to this task his extensive knowledge of West Indian prehistory and of archaeological method. This joint effort represents one of the finest examples of cooperation between Latin American and North American institutions in the field of archaeology; the Universidad Central de Venezuela, the Museo de Ciencias Naturales of the Venezuelan Ministry of Education, and the Caribbean Program of Yale University are to be commended on the results achieved. The monograph has two objectives: to summarize the status of Venezuelan archaeology as of 1957, and to formulate a detailed chronology on the basis of the spatial and temporal distributions of ceramic styles and non-ceramic complexes.

The extent to which archaeological field work has been extended throughout Venezuela in the last two decades is indicated by the large number of areas, 27 all told, from which data are available for the formulation of the chronological scheme presented by Cruxent and Rouse. The authors first determined the sequence of styles and complexes in each area by means of stratigraphy, seriation or both. The styles and complexes from area to area were then correlated and a chronological chart for each of five major geographical regions was drawn up. The regional sequences were established on the basis of historic correlations, the order of occurrence in local sequences, the relative depth of deposit, geological correlations, the presence of trade objects, stylistic comparisons, and comparisons of non-ceramic artifacts and of sites. Similar and contiguous styles were grouped into series and the most elaborate style in each series was selected as the type style. As the authors point out, the series represent the most speculative element in their conclusions, largely due to the unevenness of present information, and in some instances may require revision when more data become available. Ten such units are defined: (1) Manicuaroid, the sole non-ceramic series, existed through Periods I and II on the islands of the Cubagua group and the neighboring east coast. Bone projectile points, shell gouges (which make their appearance in the last half of Period I), and bi-pointed stones are the principal artifacts. (2) Saladoid, the first of the ceramic series, appeared early in Period II on the Lower and Middle Orinoco and extended to the east coast, Trinidad and through the Lesser Antilles to Puerto Rico by the end of Period II. During Period III it persisted on the Middle Orinoco and the east coast, spread to the Upper Orinoco and Margarita Island and appears to have died out in the Antilles. It is distinguished by flat-based, flaring-sided bowls wtih vertical strap handles and white-on-red painted decoration. (3) The Barrancoid series appeared somewhat before the middle of Period II on the Lower Orinoco and occurred in the Valencia area and on the central coast in the latter part of the period. It persisted in all three areas during Period III and on the central coast into Period IV. During the latter part of Period III it reached Trinidad and British Guiana and influenced the rest of the Antilles. Annular-based, rim-flanged bowls with modeled-incised lugs and incision on rim flanges are characteristic. (4) The Tocuyanoid series is defined in terms of tripod or tetrapod bowls with a distinctive form of leg, painted curved designs in red, black, or both on white, and broad-line incision. It appeared in the latter half of Period II in four styles of the central coast, the west, and western Llanos. Only one Tocuyanoid style is known from Period III, but the authors point out that there must have been others further west. (5) The Arauquinoid series first appeared during the latter half of Period III, was characteristic of Period IV on the Middle and Lower Orinoco and in the San Fernando area, and was found in a Period V style on the Lower Orinoco. Modeled-incised lugs and rim flanges decorated with broad line incision of a Barrancoid character are accompanied by sponge-spicule tempering, rectilinear fine line incision, appliqué work and appliqué faces on the collars of globular jars. (6) The Ocumaroid series combines Saladoid traits such as flat bases and non-flanged rims with Tocuyanoid red or black on white painting. It appeared in Period III on the Central Coast where it persisted through Period IV. (7) The remaining series date from both Periods IV and V. Dabajuroid apparently developed on the west coast and was widely distributed in the coastal area. The elaborate Dabajuro style is distinguished by shapes of a Tocuyanoid character but also shows elements found in all previous series, including both annular and leg bases, Tocuyanoid red or black on white painted designs, incision, punctation, appliqué work, corrugation and fabric impression. (8) The Tierroid series shows certain similarities to Dabajuroid and is distinguished by fine sand temper, somewhat less variety in shapes than Dabajuroid, emphasis on painted decoration in varied combinations of red, black, and white and with distinctive, often minute designs. It is widely spread through the western mountains and into the central coast and the southwestern Llanos. (9) The Valencioid series pottery is mineral tempered, rather coarse, has plain or annular bases, and globular jars are the dominant form. Painting is absent and decoration consists instead of relatively crude punctation, incision, appliqué work, and lugs

with applied features. Styles of this series are found in the central mountains and the mountains to the west, the central and east coast and the offshore islands. (10) Finally, in the Memoid style of the Central Llanos decoration consists mainly of roughening the surfaces with corrugations and finger, fabric, or cord impressions. The non-ceramic El Jobo complex, known from numerous surface deposits in northwestern Venezuela, is assigned on typological grounds to a paleo-Indian period.

The authors obtained charcoal samples associated with various styles and complexes and, on the basis of 25 radiocarbon analyses as well as of a number of geological and historical correlations, have assigned absolute dates as follows: paleo-Indian, before 5050 B.C.; Period I, 5050–1050 B.C.; Period II, 1050 B.C.–A.D. 350; Period III, A.D. 350–1150; Period IV, A.D. 1150–1500; and Period V, A.D. 1500 on. Discrepancies between the relative chronology, glottochronology, and radiocarbon dates were analyzed and reconciled. Of general interest are a number of comments by the authors on the reliability of radiocarbon dates based on their experience in Venezuela.

Almost 200 pages are devoted to the description of styles and complexes and a comparative and chronological analysis is given with each such unit. The excellent and abundant illustrations enable the reader to form a clear picture of each style. By their meticulous and systematic analysis the authors seem to have overcome difficulties arising from uneven sampling. I concur in the opinion that the Ronquín style collections which I excavated in 1941 might well be restudied with a view toward further clarifying differences between the upper and lower levels and possibly showing a closer relationship between Saladero and the lower Ronquín levels. As the authors point out, Barrancoid resemblances do occur but, contrary to the statement on page 244, flange rims are not numerous at any point in the time scale represented by the Ronquín collections described in 1943. Only five specimens of flanges occurred in my collections and they were found in Levels 4, 5, and 6 which contained a total of 728 other Ronquín bowl rim sherds. They lacked the typical Barrancoid incised decoration and were painted. I agree that the problem of better defining the relationships between the Ronquín style, on the one hand, and the Saladero and Barrancas styles, on the other, requires further investigation. Field surveys in the intervening area should contribute to the solution of this problem.

Of great interest are the implications of the chronology for neighboring areas. The chronology for the Antilles is revised to conform to that of Venezuela and the appearance of pottery and presumably of agriculture have been shifted from the beginning to the middle of Period II. While the earliest ceramic styles represent an extension of the mainland Saladoid series, the non-ceramic complexes of the Antilles cannot as yet be shown to be derived from the Manicuaroid series. The data for the North-West and Demerara Districts of British Guiana are reviewed and a sequence embracing Periods II through V in the former and Periods IV through V in the latter is proposed in the light of present knowledge of styles and their succession in Trinidad and the Lower Orinoco. For lack of adequate data from central Amazonia the authors submit only general remarks on resemblances to Amazonian ceramics. Following suggestions of Willey and Lathrap, it is proposed as a working hypothesis that the Hupaiya complex of the upper Amazon and certain other modeled-incised pottery of Amazonia may be derived from the Arauquinoid series. In view of the extensive data now available for areas surrounding central Amazonia it is to be hoped that surveys of that area will soon be initiated. The work of the Reichel-Dolmatoffs in Colombia and of Willey, Lothrop, and others in Panama has enabled the authors to clarify relationships between western Venezuela, Colombia, and Panama. The Panamanian and Northern and Northeast Colombian sequences conform well to the Venezuelan chronology. The beginning point for the Venezuelan Period I is established on the basis of similarities between the preceramic Cerro Mangote complex of Panama, for which a radiocarbon date exists, and the Cabo Blanco and El Heneal complexes of central Venezuela. The Tocuyanoid series appears to be derived from the First Painted horizon of Colombia to which it is linked by the La Pitia style of the Maracaibo area. The Second Painted horizon of Colombia shows similarities with the Ocumaroid, Dabajuroid, and Tierroid series.

In a discussion of cultural relationships in northern South America the authors note the existence of two centers of cultural development in Venezuela, one in the Orinoco Basin and the other apparently centering on Lake Maracaibo. The eastern center is linked with Amazonia, the Guianas and the Antilles by its ceramics and dependence on bitter cassava, while the western center is related to Andean South America and to Central America by its pottery, the absence of bitter cassava, and the presence of maize and funerary and religious developments. Cultural interaction between these centers commenced in Period III and the western center spread eastward in Venezuela during Periods IV and V. Assuming that the general sequence of development in northern Colombia applies also in the Maracaibo Basin, the authors conclude that the eastern center belonged

> to an earlier stage of development . . . which was originally present throughout the country but which persisted until historic time only in the east. The western half of the dichotomy, on the other hand, is thought to be the result of diffusion from Colombia during the middle of Period II . . . The east, therefore, qualifies as a separate cultural center and, contrary to Circum-Caribbean theory, cannot be considered a maladapted offshoot of the western center.

The authors and all others who have collaborated with them are to be congratulated on the success of this coordinated program of archaeological studies embracing a country as large and as geographically varied as Venezuela. The report is outstanding for the clarity and significant detail found throughout the descriptive sections as well as for its historical insights. There can be no doubt that it will give a new impetus to research in lowland South America for which it provides a model of field method and of stylistic and chronological analysis.

George D. Howard
Stamford, Conn.

Selected Papers from the American Anthropologist, 1888–1920. Edited by FREDERICA DE LAGUNA for the Publications Committee of the American Anthropological Association, with an essay on "The Beginnings of Anthropology in America" by A. IRVING HALLOWELL. Row, Peterson, Evanston, 1960. x+930 pp., 79 figs., 67 pls., 8 maps. $8.00.

A considerable portion — in fact, a surprisingly large part — of this volume is devoted to American archaeology specifically, or to closely related topics of direct interest and concern to archaeologists. This is true of "Part II. American Indian Origins" and "Part III. American Archaeology"; at least a few of the papers under "Part IV. Physical Anthropology" and "Part V. Language"; several of those in "Part VI. Ethnography," and even a few in "Part VII. Method and Theory of Ethnology." For example, under the last heading we find Clark Wissler, "Material Cultures of the North American Indians" (*American Anthropologist*, Vol. 16, pp. 447–505, 1914). And of general interest for all anthropologists, including archaeologists, are Hallowell's excellent 90-page essay on the early history of American anthropology and the brief historical summaries at the beginning of each part.

Virtually everything in the volume is, or would have been, of at least general interest to North American archaeologists of any breadth of scope. Only a few of the papers on linguistics — three of the five, I should say — and ethnography — possibly five or six of the 21 items — are so technical and specialized that the normal archaeologist would skip them. I make a special point of emphasizing this because it certainly is no longer true. To me the most striking and significant effect in reading, or skimming, this collection and the accompanying essays is the degree to which American anthropology was, in the period covered, all one general subject, with emphasis on the historical development and material culture of the American Indians.

In recent years, we have inevitably split up into specialized groups of archaeologists, physical anthropologists, ethnologists or social anthropologists or cultural anthropologists, each group with a specialized lingo and a different approach, each group talking among themselves almost exclusively, and each group concerned to a degree with its methodology and techniques as such, and with self-conscious discussions thereof and with other possible applications thereof, as well as — or rather than — with the concrete subject matter of the culture and aboriginal history of the American Indians, or of peoples of the extra-European world in general.

Now, the foregoing discussion is not, I realize, a review of a new publication, but rather a related comment inspired by reading through the book. Nevertheless, I believe it is the most important thing to bring out. Anyway, how can something of this nature be given either a critical review or a merely descriptive review? All I can say is that the selection of papers and editing have been well done, the volume is quite adequately produced, the "Selected Bibliography on the History of Anthropology in America" is valuable, Hallowell's introductory essay is really admirable, many of the reprinted papers are still of considerable importance in themselves, and I have observed no typographical errors whatever.

Dr. de Laguna and the American Anthropological Association are to be commended and congratulated on this highly worthwhile publication, which surely will be required reading for students in every academic Department of Anthropology and interesting reading for all of us. Finally, I should like to call attention to a pertinent recent paper, by G. W. Stocking, Jr., "Franz Boaz and the Founding of the American Anthropological Association," in the *American Anthropologist* (Vol. 62, pp. 1–17, 1960).

ERIK K. REED
National Park Service
Santa Fe, N.M.

The Evolution of Man: Man, Culture and Society. Edited by SOL TAX. Vol. II of Evolution After Darwin, The University of Chicago Centennial, University of Chicago Press, Chicago, 1960. viii+473 pp., 15 figs. $10.00.

"There is a sort of huge disproportion between Darwin's specific contribution to science — the origination and substantiation of the principle of natural selection — and the overwhelming effect which the establishment of this purely biological principle came to have on total science." In this opening sentence of the initial article of this volume, A. L. Kroeber succinctly presents the theme of this collection of very fine essays by some of the leading scholars of the world. It is certainly a fitting companion to the biologically oriented Volume I of the three volume set examining the century of evolution since publication of the *Origin of Species*.

The articles comprising Volume II are quite diverse enough to illustrate the sentence quoted above. Kroeber's *Evolution, History, and Culture* traces the acceptance of Darwinian theory in general science, and specifically, in anthropology. Articles by L. S. B. Leakey, S. L. Washburn and F. C. Howell, and C. Emiliani are concerned with human evolution; Edgar Anderson writes on domestication; S. Piggott, F. Bordes, G. R. Willey, R. J. Braidwood, R. M. Adams, and J. H. Steward have compositions pertaining to prehistory. Essays by H. W. Magoun, A. von Muralt, W. H. Gautt, and L. A. White relate to aspects of human behavior. More psychologically directed are several articles by R. W. Gerard, E. R. Hilgard, M. Chrichley, A. I. Hallowell, and H. W. Brosin. Finally, there are two speculative treatises on the future of mankind by H. J. Muller and Sir Charles Darwin.

Not all the contents of Volume II of this great collection would interest American archaeologists, but a number of the papers are of such nature that any archaeologist can profit by reading them. Particularly important are such concerns as Edgar Anderson's *The Evolution of Domestication*. Archaeologists generally recognize the fact that their interests are far broader than that of the mere antiquarian and here is an opportunity to have an evaluation of the work of the recognized botanists and cyto-

genetecists of our time. Although Anderson could do little more than indicate the statistics of research on plant domestication, his clear message is that few cultivated plants are monophyletic in origin. Despite archaeologists' dreams of glory as finder of the wild plant from which sprang maize, it seems patently impossible to trace maize through its multitudinous ancestry. Truly, maize seems well named. Anderson suggests a multiple origin for agriculture that demands a tremendous amount of field and laboratory work but seems the only device that will cast light upon this complex problem.

The three articles concerned with human evolution are quite timely and helpful in reorganizing our thinking about the evolution of man, the organism, as a concomitant of the evolution of man, the superorganic. Leakey, the Afrocentrist, points out that "Darwin believed that the most likely continent in which to search for evidence of human evolution was Africa." His article is a personal document, reviewing the many specimens of fossil simians, pongids, and hominids that have assumed mountainous proportions in East and South Africa. Leaky finds in Africa every significant stage in evolution from *Proconsul* (distinctly non-simian in the Oligocene) to *Homo*. Threading a way through the numerous scientific names given to these many fossils of man and pre-man, one cannot but agree with Leakey's plea for taxonomic order in the Hominoidea (a suborder in some classifications).

All too often, it is forgotten that Darwin erected his monumental works on virtually no fossil-bearing foundation. Washburn and Howell remind us that in 1871 when *The Descent of Man* was published, "only the Neanderthal skull cap and the Naulette lower jaw were known to Darwin," and "almost the whole science of prehistoric archeology has developed since." I doubt that the Naulette specimen (a Neanderthal) is known to many anthropologists today. In their *Human Evolution and Culture*, they show that a modern evaluation of man's evolution departs but little from what Darwin suggested nearly a century ago. It is the wealth of details that they may now supply that enables a clearer picture of human evolution from a basic Australopithecine of Late Villafranchian age to *Homo sapiens* of modern times. Of great interest is the repeated returns of these authors to Darwin's assertion that tool-using in earliest men "caused" a reduction in dentition and facial skeleton in *Homo sapiens*. The search for "cause" in evolutionary theory has never improved upon Lamarck. Washburn and Howell, like most theorists reconciling biological and culture factors, can not bring themselves to the "as if" position.

Emiliani, in *Dating Human Evolution*, has packed more vital information in a small compass than any recent writing on this subject. It seems inevitable that our Pleistocene time table will be shortened. The use of radioactive isotopes as the basis for dating ocean sediments gives several sources for dates of past events that were more or less world-wide in effect. Although necessarily restrained in final conclusions, Emiliani gives a lucid account of what has been done recently in geochronology and what might be expected in the near future. It is evident that Americanist archaeologists can not fully appreciate their problems in prehistory without a thorough acquaintance with the ubiquitous Pleistocene.

Of more immediate interest to archaeologists are the articles directly relating to prehistory. In *Evolution in the Paleolithic Cultures*, F. H. Bordes critically reviews the status of our knowledge of the relationships among tool types in the European Paleolithic. The most obvious fact he reveals is that many of the early excavation data, upon which most of the early culture history of Western Europe is based, are nearly useless in modern comparative studies. His short study includes some consideration of the interrelationships of unilinear evolution, multilinear evolution, and culture history. In view of the present widespread renewed interest in cultural evolution, anything that renders a greater clarity of meaning among these quite different aspects of evolutionary theory is well worth the effort. Bordes could have greatly enhanced the value of his paper by a few key explanations.

One of the fine features of G. R. Willey's *Historical Patterns and Evolution in Native New World Cultures* is just the fact that he does open his article with a few succinct sentences about the nature of the evolution of culture. An idea that has been anathema to most cultural anthropologists is the use of the biological model for cultural evolution, hence, it is particularly pleasing to the reviewer to find Willey kindly disposed to at least considering the prospect that a culture with a given technology exploits its niche in nature much as a constantly mutating gene pool is adapted to a particular geographic environment. When cultural evolution is considered a natural extension of organic evolution, our thinking about the total process of evolution will be greatly clarified.

Willey's paper draws together some of his conceptionalizations about American culture history that he has previously explored, but an interesting aspect of this article is the evident shift in his emphasis from culture history or the history of individual cultures to culture process as it affects the whole New World. As one examines the literature of American archaeology of the past century, the impression is borne out that the interests of intellectually maturing scholars shift from history to process. Despite some difficulties in regional application, Willey's schematic diagram of what happened in American culture history will serve most archaeologists, particularly teachers, for some years to come. Americanists have reached that stage of knowledge about their field that not many startling revelations may be anticipated. It may be expected that refinements will be made but it seems assured that the over-all framework will be that outlined by Willey.

In a tantalizingly shortened paper on *Levels in Prehistory* Braidwood makes a most promising suggestion regarding our thinking about the prehistory of man, but then, I think, he fails to fulfill the promise. He suggests that current classification schemes should be largely abandoned and new ones erected on "an intuitive assessment of a still highly incomplete body of archeological evidence." Anything to discourage the fiction that science draws its theory from empirical data should be lauded. Braidwood's diagrammatic representation of the cultural

past of mankind attempts to avoid the errors of outrageously slung together family trees of previous classificationists. The unique quality of his endeavor is the attempt to indicate the degree and geographic extent of diffusion at given levels of growth. Efforts to depict three dimensions in two are foredoomed to some measure of failure, yet this is certainly an encouraging beginning.

The longer article by R. M. Adams, *The Evolutionary Process in Early Civilization*, is quite a stimulating treatment of the same area of interest as Braidwood's. Adams points out that as man's cultural equipment has become greater, the deterministic role of his organic background has become lessened. He further argues that "the evolutionary mode of analysis" is one that "embodies an empirical orientation that is based on command, rather than on rejection, of descriptive cultural detail." I believe this is a cogent statement of the status of use of evolutionary theory in cultural anthropology today. It is much more epistemologically sound than the conclusion of Steward in his article, *Evolutionary Principles and Social Types*, that the current flair for evolutionary theory merely honors Darwin's centennial. However, in fairness to Steward, it should be mentioned that his concluding remarks show his awareness that out of current evolutionary studies and hypotheses, though they be but close shadows of 19th century theories, there may come newer universal principles that "will have a more solid empirical basis."

Adams' article, none the less, deserves careful reading by all archaeologists, since he tries to assure an archaeological source for his speculations. Although interested in the entirety of human prehistory, he chooses the beginnings of civilization as the testing ground for application of evolutionary theory. He reviews the basis upon which various classifications of stages of cultural development have altered Barbarism to Civilization: Childe's modifications of Morgan; Steward's "levels of sociocultural integration"; Fried's social differentiation; and finally, his own "contrast between independent temple-centered communities and the stratified, militaristic, urban state." It seems to me, a curious omission that no mention is made of Leslie White's "energy utilization" criterion, although reference is made to his *Evolution of Culture*.

In general, these several articles that pertain to evolutionary theory in application to archaeological data are very stimulating and indicative of a renewed interest in reconstructing the past in the light of our more recent data. They possess a similarity in one feature that only time will dissipate, namely, none of them clearly differentiates cultural evolution from the evolution of cultures. Despite these being but aspects of the whole and its parts, confusion of the two can lead to no clear understanding of generalized principles.

The two last essays in this volume are by most prominent figures in world science. H. J. Muller, an American Nobel Prize winning geneticist, has written *The Guidance of Human Evolution*, and Sir Charles Darwin has explored *Can Man Control His Numbers?* It may appear presumptive on my part to criticize such eminent scholars, but cultural anthropologists are constantly aware of the inability of many a great scientist to evaluate properly the role of culture. Muller would have us believe that if man, species *Homo sapiens*, were to disappear, then culture would perish, since man as presently constituted survives because of his distinctive characteristics. Only by consciously controlling his biological future can man "evade the otherwise inevitable decline." It seems obvious that little progress in this sphere of theory has been made in the last century. If modern man demonstrates anything it is that cultural equipment enables him to transcend biological inadequacies. I prefer to believe with Adams that man's biological make-up is a gradually diminishing problem to students of those aspects of behavior that are peculiar to humans.

WILLIAM G. HAAG
Louisiana State University
Baton Rouge, La.

Evolution and Culture. Edited by MARSHALL D. SAHLINS AND ELMAN R. SERVICE. University of Michigan Press, Ann Arbor, 1960. xii + 131 pp. $3.75.

Evolution and Culture is composed of five chapters, each a separate essay, yet all interrelated and infused with a unitary point of view. They are written with verve and conviction. White, in his *Foreword*, describes the book as "the best recent treatment of cultural evolutionism that we have seen."

The *Introduction*, by Sahlins and Service, places the controversies of cultural evolution in historical perspective. The chapter on *Evolution: General and Specific*, by Sahlins, sets out and explains the differences between these two concepts. "General cultural evolution . . . is passage from less to greater energy transformation, lower to higher levels of integration, and less to greater all-around adaptability. Specific evolution is the phylogenetic, ramifying, historic passage of culture along its many lines, the adaptive modification of particular cultures" (p. 38). The "universal evolution" identified with Leslie A. White corresponds to the former while Julian H. Steward's "multilineal evolution" is a concern with the latter. This theme of the specific and the general in evolution is basic and runs through all the other essays. Thomas G. Harding's chapter, *Adaptation and Stability*, develops the thesis that ". . . while adaptation is creative . . . it is also self-limiting. A particular technology requires particular social adaptations for wielding it, and conversely a given social order is perpetuated and coordinated by deployment of technology" (p. 54). David A. Kaplan then deals with the *Law of Cultural Dominance*, defined as: ". . . that cultural system which more effectively exploits the energy resources of a given environment will tend to spread in that environment at the expense of less effective systems" (p. 75). Environment, in this instance, subsumes natural, social, and cultural settings. A corollary of this law is that while "specific evolution leads to increasing *adaptation*, it can be said that general evolution leads to greater *adaptability* — which is

not the same thing" (p. 70, author's italics). In the last chapter Service phrases the *Law of Evolutionary Potential* as: "the more specialized and adapted a form in a given evolutionary stage, the smaller is its potential for passing to the next stage" or, put in other words, "specific evolutionary progress is inversely related to general evolutionary potential" (p. 97). Service's chapter also serves to restate and to tie together the several lines of argument of the preceding essays.

Evolution and Culture is a strong, stimulating, and controversial book. I can touch on only a few of its points. One of these is the important matter of general and specific evolution. I find the distinction between the two useful and clarifying up to a point. I understand and accept specific evolution as history plus explanation of process — the story of how a given culture, or culture continuum, changed through time by the processes of its adaptations to natural and superorganic environments. General evolution of culture is less convincing to me insofar as its processes are obscure. Unlike biological forms, highly specialized and successfully adapted forms in culture do not become complete "dead-ends" without progeny. Instead, as the authors of *Evolution and Culture* are careful to explain, they may influence by diffusion other less specialized and advanced cultures and give these latter the impetus to go on to higher levels of evolution. This influencing, according to their thesis, always begins decisively and determinatively in the field of technology. They adduce examples from archaeology and history which may be so interpreted; but I can think of other situations which are puzzling. For instance, what in observable technology, other than the very general trait of flint-chipping, did the wild seed and plant collectors of ancient North and Middle America borrow from the essentially earlier and much more specialized big game hunters? How could the store of experience and skill in stalking and killing the mammoth be transferred as technical knowledge to improve the gathering and utilization of wild seeds and berries? There must have been contact between peoples of these two patterns; geographical and chronological overlap is indicated; and the seed and plant collecting cultures eventually surpassed the big game hunters in total energy capture and organization. Yet there is a glaring disjuncture in the evolution of technology between the two. Could it be that cultural and social traditions other than those of technology and subsistence provided the transferable heritage that helped the cumulative build-up of general cultural advance? This is, of course, contradictory to the central mechanism of evolutionary theory, as expounded in the book (p. 46), that technology is the basic determinant.

The authors' insistence that the technico-economic realm must always be given priority in explaining the processes of culture change is central to my disagreements with these essays. I readily concede that the relationships between the technological and societal aspects of a culture and its natural environmental settings are the ones most easily seen and documented. This is notably true in archaeology where the take-off point for interpretations is in material objects and the earth. It is also obvious that there are interdependences between these aspects and the ideological side of culture; but the nature of the interdependences appear to me as the primary problem in any particular anthropological study rather than a resolved, generalized axiomatic finding. *Post hoc* explanations are fascinating, but they have a way of fitting starting premises. Sahlins sees the giantism and florescence of Easter Island stone heads as adaptations of farmer kin-group subsistence labor organizations to esthetic ends (p. 25). In another context I have often wondered if the singular drabness and loss of sculptural adornment of great Peruvian architecture of the later pre-Columbian periods resulted from increased communal regimentation of labor and a concomitant suppression of the individual artist and artisan — a sort of opposite effect to the one Sahlins postulates. Both suppositions, in their particular historic settings, may be correct although both will be difficult to prove.

In his discussion of the "principle of local discontinuity," a corollary of the "law of evolutionary potential," Service suggests to the archaeologists that new stages of cultural development will not take place within the same geographic zone, or within the same phylogenetic continuum, as the achievements of a preceding stage. He cites the absence of ancestral local stages to the civilizations of Mesoamerica, excepting the Middle or Formative cultures as the "succession from (these) is expectable as an instance of specific evolution, gradual progress in adaptive specialization within the stage" (p. 105). He goes on to state that "the great leap in progress from a hunting-gathering stage to the fully agricultural stage of the Middle Culture (Formative) would presumably follow the principle of local discontinuity." Service's hypothesis is something for archaeologists to test in various situations, but this particular case is confused. If by an earlier "hunting-gathering stage" he is referring to the big game hunting pattern, it is true that manifestations of this pattern, while present, have not yet been found in abundance in Mesoamerica. If, on the other hand, he is thinking of the wild plant collecting and small game hunting pattern, this mode of life is well represented in the Mesoamerican area; and, rather than showing a sharp discontinuity with the later agricultural levels, it provides the context for a long and gradual in situ sequence of incipient-to-established Mesoamerican cultivation and the rise of the Middle cultures.

Service in the final section of his chapter, subtitled "The Present and Future of America," uses general evolutionary reasoning to predict the future and to suggest policy for ourselves and our world. Although the subject matter lies somewhat outside the usual scope of an archaeological journal, the emphasis placed on this section calls for some comment. I recognize the difficulties and imbalances of modern political systems without industrial foundations; nevertheless, I am dubious that the introduction of industrial technology will in itself touch off a train of development leading inevitably to the democratization of the underdeveloped nations. Japan, Ger-

many, and Russia all assimilated the industrial revolution relatively late and without a democratic ideology, and the results have not been an unrelieved march toward human dignity and freedom. Industrial might grafted onto non-democratic ideologies rather than freeing people and cultures for new levels of attainment may only provide tyrants with the steel to bind their governed populations down more securely.

To summarize, I accept specific evolution of culture insofar as this can be traced in phylogenetic lines and as it explains the growth and change of forms through adaptation and diversification. It is easier for me to detect and understand such adaptations as they involve technology, natural environment, and social groupings. Adaptivity as it concerns the ideological sphere of culture is more difficult to perceive [G. R. Willey, Historical Patterns and Evolution in Native New World Cultures, in *Evolution After Darwin*, edited by Sol Tax, pp. 111–41, 1960]. I do not deny that the ideological realm is interrelated in its development with technology and society, but I do not see any one of these aspects as the constant and master determinant. Second, as one whose anthropological interests have been overwhelmingly historical (archaeological), I agree that the course of world history may be used to support a theory of general cultural evolution; but until the processes of this general evolution are better understood, particularly as these pertain to the way in which the many streams of specific evolution feed into the main one, I cannot appreciate the difference between a general universal evolution of culture and a general universal culture history. Finally, and derivative from some of the misgivings noted above, I would not read in the record of the past the same implications for the future which the authors of *Evolution and Culture* see in it. In brief, I do not feel that the key determinant of democracy is modern technology nor that an "across-the-board" implantation of industrialism in non-industrial cultures, unaccompanied by any of the ideological contexts in which this industrialism first grew up, will result in an inevitable victory for democracy and humanity.

GORDON R. WILLEY
Harvard University
Cambridge, Mass.

Essays in the Science of Culture in Honor of Leslie A. White. Edited by GERTRUDE E. DOLE AND ROBERT L. CARNEIRO. Thomas Y. Crowell Co., New York, 1960. xlvi + 509 pp., 17 figs., 1 map. $6.25.

Four of the articles in this volume are immediately pertinent to archaeologists:

The Cultural Background of the Iroquois by Alfred K. Guthe (pp. 202–15) is addressed to the problem of Iroquois origins. Guthe notes that Parker's theory of a recent Iroquois migration from the south has lost favor to MacNeish's hypothesis of development from the local, Owasco culture. Nevertheless, he points out, a culture like Iroquois cannot be expected to have developed entirely from a culture like Owasco; it should have received some of its traits from its neighbors by means of diffusion. Previous authors had attempted to show Owasco-Iroquois continuity by citing the similarities between the two. Guthe concentrates instead on the differences, in order to show that some elements of Iroquois culture cannot be derived from Owasco. He concludes that earthworks, ossuaries, and the rectangular house plan are all likely to have diffused to the Iroquois from cultures farther west (sometimes called "Owascoid") instead of being derived from Owasco itself.

The discussion might have been sharpened by making a distinction between the origin of the Iroquois people and the source of their culture. MacNeish was concerned with the former, that is, he attempted to determine the origin of the various Iroquois tribes by tracing them in terms of their distinctive pottery types. Guthe's article does not contribute to the solution of this problem but does perform the service of demonstrating that the origin of Iroquois culture traits is likewise a problem worth studying.

In *Habitat, Culture, and Archaeology* (pp. 380–9), George I. Quimby puts together White's theory of cultural evolution, his own knowledge of Naskapi and Central Eskimo culture, and Wissler's postulate that habitat determines the limits of diffusion, in order to produce the following hypothesis: ". . . under certain conditions a hunting culture will develop over a period of time to the limits of its habitat and in so doing will acquire cultural forms determined by the habitat." He goes on to give several technological forms to which Naskapi- and Eskimo-like habitats should lead, suggests several kinds of sociological systems which should be determined by those technological forms, and concludes, "I envision these hypotheses and ideas as archaeological aids possibly useful in the reconstruction of culture history in the Upper Great Lakes region where there was a period of about 10,000 years during which culture was based upon a hunting economy."

Since Quimby is interested in a specific historical situation, he does not generalize by giving the conditions under which his hypotheses will or will not hold true. It seems to me, however, that he is discussing an extreme situation, in which it is barely possible to obtain an adequate subsistence from the environment. His hypothesis of environmental determinism is reasonable in this situation, but I doubt that it will work so well in a more favorable environment that would allow more opportunity for cultural variation.

The Dimensions of Archaeology by Albert C. Spaulding (pp. 437–56) is, in my opinion, a gem. Its conciseness, the explicitness of its assumptions, and the logic of its reasoning from those assumptions are admirable. Spaulding is concerned with the handling of empirical data in archaeology. These data, he says, consist of artifacts and they may be studied in terms of three dimensions, form, time, and space. Artifact attributes comprise the units of the dimension of form. Archaeologists may either tally the appearances of the attributes on artifacts,

list their combinations, or determine attribute clusters by means of mathematical analysis. For Spaulding, the last constitute artifact types. The spatial dimension is depicted as the context of the artifacts within sites, while the temporal dimension consists of an absolute or relative time scale. Spaulding discusses the relationships among these three dimensions and stresses the need to keep them distinct for the sake of clear thinking.

Spaulding comments that "a great gain would result if my purpose could be realized fully: questions of fact would be sharply separated from questions of theory, thus pointing accurately to those topics on which factual data are needed and providing a guide for research along the most effective lines." I would agree with the first half of this proposition — the article succeeds very well in demonstrating the needs for facts — but doubt the second half. It does not seem to me that research can be effectively done without taking into consideration questions of theory. The strength of Spaulding's article lies in his elimination of theoretical questions, but its scope is thereby limited, relative to other works on archaeological method.

Archaeological Sampling: a Problem of Statistical Inference by G. S. Vescelius (pp. 457–70), discusses methods of collecting artifacts from the surfaces of sites. According to Vescelius, it is impracticable to use the statistically reliable method of random sampling for this purpose, and so site surveyors customarily have recourse to haphazard "grab sampling." He recommends the use instead of "cluster sampling," in which the archaeologist lays out a grid and collects from randomly chosen units of the grid. He explains how to estimate proportions from cluster samples and how to calculate the standard error. The article is well written and was relatively easy for me to follow, despite an obtuseness in statistics.

Irving Rouse
Yale University
New Haven, Conn.

The First Comers, Indians of America's Dawn. Alice Marriott. Illustrated by Harvey Weiss. Longmans, Green, New York, 1960. vii+246 pp., 50 line drawings. $4.50.

For some time, interested readers of all ages have been asking anthropologists for a clear non-technical, but authoritative survey of North American archaeology. *The First Comers* is such a book. The tone of this book is set in the Foreword.

> History — and beyond it, archaeology — is not dates and battles, or the maneuverings of politicians. History and archaeology are the lives of human beings: of men, women, and children, who felt and acted and believed much as we do, even though their material surroundings and circumstances were not like ours in many ways.

Starting from known history, the author reveals the archaeological unknown. The method is a game in which libraries and museums serve as the playing field, with books and documented artifacts being the instruments of play. The rules of the game are the fundamental concepts of anthropology. The requirements for the players are interest, intellectual honesty, and the ability to work unselfishly together.

The game begins in the library where the necessary background knowledge is found; next, to the museum: "A museum is a book and when you open its front door you are opening the book and beginning to read its story" (Chapter 3).

The museum story opens with the Archaic period in North America. We are taught how to read museum displays by means of an area in western Arkansas. From case to case the reader is led; the life of the Archaic peoples is revealed to him through specimens of tools, food, and clothing. It comes alive when the author says in Chapter 3:

> So this Indian mother, all those thousands of years ago, was a good housekeeper. She stored winter food for her family as well as she could without a canner or a deep freeze. She waded in the swamps downstream from the shelter to gather the knifesharp cutting stems of the wild cane, handling the stalks carefully in order not to hurt her hands, so she could make a mat to line her storage cupboard. She was a deft worker; the mat is beautifully made. The shiny outer surfaces of some strips of the wild cane alternate with the dull inner surfaces of others, so the herringbone pattern of the plaiting will show clearly. This woman loved her family. She worked hard to make their home a pleasant place, to make beautiful things that were meant to be used everyday.

After the Archaic period each archaeological section of the United States is treated separately. No site reports are used; each culture area is a dynamic scheme of culture development starting with history and projecting backward in time to prehistory. The archaeology game remains in the museum with its displays; exotic items of culture are always translated into reality for the student.

Humanistic values do not overshadow scientific honesty and caution. Marriott warns the reader over and over again against the destruction of scientific evidence. These warnings are climaxed in her description of what happened at Spiro Mound, Oklahoma (Chapter 8). As one associated with the University of Oklahoma excavation at Spiro Mound, she presents the most exact account of how the Oklahoma archaeologists struggled to salvage the maximum scientific data after wholesale destruction had taken place. This chapter will be valuable to both professional archaeologist and amateur interested in learning more about Spiro, the greatest tragedy in American archaeology.

To the author, archaeology is a science; in its applied form it must be practiced with precision under established rules. Throughout the book diverse archaeological techniques are explained: how to make an archaeological survey, how to dig a cave, and how to excavate a mound. Methods of interpreting the data are illustrated: the use of historical documents, the effect of ecology on material culture, and cross dating of artifacts. Techniques of dating material are discussed: where did we get radiocarbon dating, what is it, and how used? What dendrochronology is, and how used, is minutely described in connection with the Southwest cultures (Chapters 11–12). About these techniques the reader is given the facts with examples.

Marriott has devoted two chapters to museums. In Chapter 5 she gives the history of museums, telling what they do, how they get their collections and who are the people behind the museum. This chapter will be invaluable in explaining to the public the function, character, and responsibilities of a museum.

The last chapter of the book (Chapter 15) is devoted to the Hobby Archaeologist and to community groups, such as the Boy Scouts and Girl Scouts. Again the author returns to the museum, but this time to draw upon her own vast knowledge and experience, to give practical workable advice on how to set up a museum.

There is a large bibliography, which will be extremely useful to the amateur archaeologist in search of reference material and will enable the more inquisitive reader to continue to play the "archaeology game."

The illustrations by Harvey Weiss heighten the interest of the text rather than contributing visual scientific data.

To interested people of all ages this book will be a welcome contribution; to the informed it may appear too generalized. All will agree, however, that in the areas where the author is most familiar the dynamics of culture become living realities; while in the areas less familiar to the author the vividness of culture is somewhat diminished.

Further, all will agree that Marriott has fulfilled her objective, stated in her Foreword:

> Most especially I should like to give other people the sense of sharing and belonging that is a part of archaeology in the field and in the museum. Tennyson makes Ulysses say, "I am a part of all that I have met." It is a good motto for anybody; it is a necessary motto for those of us who are interested in the peoples of the past.

Carol K. Rachlin
Oklahoma City, Okla.

The Prehistory of Southern Africa. J. Desmond Clark. Penguin Books, Harmondsworth and Baltimore, 1959. 341 pp., 71 figs., 16 pls., 15 maps, 7 tables. $1.50.

Southern Africa is an immense area, over two thousand miles long and nearly as wide in the northern part. It contains well over a million square miles of savannah and open forests which formerly teemed with countless game of many kinds. With no winters to reduce their numbers and no glacial advances to bring cold and extinction, the plant and animal life of Africa provided a continuing economic base for the life of ancient man. During a time of glacial advance there may easily have been ten times as many men in southern Africa as in Europe, and *The Prehistory of Southern Africa* brings order and meaning to this vast piece of human history.

The contents of the book are easily summarized by the following list of the headings of the eleven chapters: the land and the people; building up the story; the man-apes; fossil man in southern Africa; unspecialized hunter-gatherers; specialization begins; the microlithic revolution; the later Stone Age; daily life in the later Stone Age; prehistoric art; miners, metal workers, and builders in stone. There are over two hundred references and a useful index. Written by an expert who has been Director of the Rhodes-Livingstone Museum for over 20 years, this is a most useful book for teacher or student.

Although the illustrative materials are all from southern Africa, the problems are of far wider scope and interest: the evolutionary position of the man-apes and the problem of the earliest tools; the great Chellian-Acheulian tradition and the hunting methods of early man; specialization and the ecological determination of later cultures such as the Sangoan; the importance of the microliths, compound tools, the bow, and poison; the late appearance of metal working, stone building, and domestic animals. This is functional archaeology at its best. Ethnological information is combined with the archaeological data to recreate the life of ancient man, and this is done with rigorous control and great perception.

This book was planned as part of the Penguin series of Pelicans on Africa, and, therefore, no attempt was made to relate the southern African situation to all of Africa or to non-African areas. This is unfortunate as much has happened since Cole's *The Prehistory of East Africa* (Penguin, 1954) was written. Comparison with McBurney's *The Stone Age of Northern Africa* (Penguin, 1960) is difficult as that book contains no general tables of climatic and cultural sequences. *The Prehistory of Southern Africa* would be more useful if a final comparative chapter were added, and the Pelican archaeological series would be improved if some basic comparative charts, maps, and tables were included in all volumes.

S. L. Washburn
T. D. McCown
University of California
Berkeley, Calif.

Prehistoric Paintings of the Diablo Region of Western Texas. A Preliminary Report. David Gebhard. Roswell Museum and Art Center, Publications in Art and Science, No. 3, Roswell, 1960. 102 pp., 9 pls., 1 map.

Gebhard's publication is a detailed study of one small segment of the prehistory of the Trans-Pecos area of west Texas. It adds another chapter to the slowly accumulating literature on pictographs of the western United States. The analytical study is based on 22 visited sites, 13 of which were selected for a concentrated study and recording. There are an estimated 100 pictographic sites in the Diablo region, on both sides of the international border, with an indication that this number is only a fraction of those to be found south of the Rio Grande. Working with such a small sampling of the potential data, the author is understandably cautious about any sweeping statements concerning areal styles.

Utilization of previous pictographic studies of the west Texas area such as A. T. Jackson, Forrest Kirkland, Victor J. Smith, as a basis for comparative study with the

sites reported in this publication has led the author to propose a revised chronology of styles and types for the area. Stress is placed on the "tentative" nature of the chronology, based on six recognized types, which range from the Pecos Polychrome style through Historic Style drawings. The usual criteria of differentiation have been used — superimposition of figures, degree of weathering, differences in stylistic characteristics.

The validity of these styles seems apparent, although unfortunately too few plates are included for a good comparative look. Whether or not the Pecos style is "dominated by an extreme nervous tension" (p. 34) is certainly a matter of personal interpretation and may perhaps be determined some day by a psychologically-minded art critic. The description of pictographic art techniques seems almost a standard for such studies. These early Texans employed the usual hematite, manganese, limonite, and gypsum.

Gebhard's field technique of location, recording and photography of sites is very thorough. Experiments with all the methods of drawing, tracing on acetate, color and black and white photography prove that all is better than one! Rather than the usual plea for "more study" the author presents a detailed four-page recommendation for future study of the area that would give us not only comprehensive information on pictograph and petroglyph sites, but also on the whole Pecos focus itself.

His final point about the advisability of turning some of these more important sites into National Monuments seems a very worthwhile idea. Judging from the letters, calls, and personal queries that every museum in the western United States gets about pictographs every year, these are almost as interesting to people as the collection of "arrowheads," and a re-evaluation of Garrick Mallery's 1882 B.A.E. report is long overdue. Let us hope that this study will stimulate others working in the western states to expand our information about these paintings, which form such a rich and varied panorama of the life and religious concepts of the vanished peoples who produced them.

H. Thomas Cain
Heard Museum of Anthropology and Primitive Arts
Phoenix, Ariz.

Excavations in the Upper Little Colorado Drainage, Eastern Arizona. Paul S. Martin and John B. Rinaldo. Fieldiana: Anthropology, Vol. 51, No. 1, Chicago Natural History Museum, 1960. 127 pp., 61 figs. 2 tables, 1 map. $4.00.

This publication is another concise report of the archaeological work that has been carried on for many years under Martin's direction. Like other publications by Martin and Rinaldo, it is well organized for an understanding of its contents and for use with comparative materials. The report covers the 1957 investigation of two non-pottery sites, a pit-house site, and an incipient pueblo village, all located in east-central Arizona. The correlation of the non-pottery sites as a variant of the general cultural pattern of the food-gatherers (Desert Cultures: Cochise) seems justified. As pointed out by the authors, the manifestation appears to be comparable to that of the Conchos complex. The presence of grinding tools in the Conchos complex, as defined in this report, has also been established by the findings of David A. Breternitz (Additional Stone Tool Types from Concho, *Plateau*, Vol. 29, No. 4, pp. 78–80, 1957).

The excavated sites conform to patterns established by others in adjoining areas: the pit-house village is a sort of peripheral Mogollon and the pueblo site a derivative phase. The tentative designation of a feature of the pueblo site as a "walk-in well" will likely puzzle the reader, as much as its presence did the excavators. Other than being "near a stream bed," any features suggestive of a walk-in well are not described in the report.

The consistent non-conformity of the radiocarbon dates obtained for both the non-pottery and later cultures is not uncommon. Series of radiocarbon dates may be consistent in their relative ages, while the dates themselves are not necessarily accurate. At best, radiocarbon dating is another tool to be used by archaeologists in age interpretations, but is not the only one.

The photographs showing field views, excavated features and artifacts are of excellent quality and provide adequate coverage of the subject matter; their reproduction meets the highest standards. The text, along with line drawings of house plans and sections, provides full details of the investigations. The cultural relations are discussed, and correlations pointed out in a comprehensive summary.

This is the sort of report that will serve a need in the future; the fact that it has been made available soon after the work was done adds to its present value.

E. B. Sayles
Arizona State Museum
Tucson, Ariz.

Ninety Years of Glen Canyon Archaeology, 1869–1959. William Y. Adams. Museum of Northern Arizona, Bulletin 33, Glen Canyon Series No. 2, Flagstaff, 1960. vi+29 pp., 3 tables, 3 maps. $2.50.

In 1957 with the beginning of dam construction at several points in the Upper Colorado River Drainage — Glen Canyon, Arizona and Utah; Flaming Gorge, Utah and Wyoming; Navaho, New Mexico — the Upper Colorado River Basin Salvage Program was established. Contracts for salvage of archaeological, ecological, and historical materials in certain areas of the drainage system were awarded the Museum of Northern Arizona, the University of Utah, and the Museum of New Mexico. Work in these fields is underway with archaeological salvage assuming the major attention of the investigating agencies. Archaeological activities up to now

have been particularly concerned with survey in order to locate all archaeological sites in or near reservoir areas. Now, in most instances, survey programs are well enough advanced or completed so that attention may be directed to excavation programs. Reports upon various phases of the programs have appeared since 1957.

The report by William Y. Adams is a result of his participation in the Glen Canyon project, but was compiled as a by-product of his official activities with the project. It is an outgrowth of his efforts to correlate the different site numbers that have been assigned by various expeditions in Glen Canyon, to reconstruct systematically the history of archaeological research in the region, and to place the different expeditions in their proper chronological sequence.

The report is concerned with the Glen Canyon of the Colorado River from July 28, 1869, when Major John Wesley Powell and his party entered what they were later to call Glen Canyon, to 1959, when the Upper Colorado salvage program had been functioning for two years.

During the first 88 years of Glen Canyon archaeology no fewer than 37 expeditions had made archaeological observations or collections in the Glen Canyon Basin. However, when the salvage program began in 1957 the area was referred to as virtual terra incognita since few published professional reports on the area had appeared. Most of the work of the early expeditions was reported, if at all, in unpublished field journals. Only a minute fraction of the information collected ever found its way into our knowledge of the prehistory of the Southwest. Thus, in addition to a program of salvage involving field operations, there is reason to believe that there is need to attempt to recover and reconstruct the work already done. Adams has laid the foundation for such a program by this brief report.

In the paper there is a short description of the region, an outline of the archaeological activities of the major expeditions, a brief description of the types and frequencies of sites in the canyon and its environs, an evaluation of the investigations to date, and an annotated bibliography of Glen Canyon archaeology. A large amount of information is condensed into tables. The principal one lists, in chronological order, 52 expeditions which have made some contribution to the prehistory of Glen Canyon. Another presents capsule archaeological histories of each of the major canyons and highlands in the Glen Canyon Basin. A third is a comparative table of place names. Three maps accompany the report, and there is a list of all other known maps that cover the area.

This is a valuable contribution to Glen Canyon archaeology and a research tool that anyone concerned with the archaeology of that area will find most useful.

ROBERT H. LISTER
University of Colorado
Boulder, Colo.

The Hubbard Site and Other Tri-wall Structures in New Mexico and Colorado. R. GORDON VIVIAN. Archeological Research Series, No. 5, National Park Service, U.S. Department of the Interior, Washington, 1959. vii+92 pp., 64 figs., 21 tables. $1.00.

The most recent volume in the Archeological Series of the National Park Service is, like its predecessors, a handsome and well-presented report on a specialized but provocative topic that has not heretofore been intensively studied. Since the very beginnings of professional archaeological interest in the Southwest, observations have been made on certain unusual masonry structures in the San Juan area of the Anasazi province. These structures are circular in plan, with two or three concentric walls surrounding a central area, with radial partitions subdividing the outer rings, and with or without a kiva in the central circle.

About ten such structures are known, all of them apparently dating from the early Pueblo III period in the McElmo, Mesa Verde, Aztec and Chaco regions. The present volume is a detailed report on the excavation of two of them, the Hubbard site at Aztec National Monument and another at Pueblo Del Arroyo in Chaco Canyon. Surface features of two others, Mound F at Aztec and a site on Chacra Mesa a few miles south of Chaco Canyon, are formally described for the first time, and comparative consideration is given to still others that have previously found their way into the literature.

The reports on the Hubbard and Del Arroyo structures are excellent examples of good archaeological statement. They are literate and comprehensive without verbosity and they give evidence of careful and intelligent excavation procedures. All data are lucidly presented and the chronological inferences drawn from the rather complex stratigraphy are convincing. The accompanying review of all known structures of this type presents certain hypotheses as to their possible function and origins. From a careful analysis of stratigraphy, ceramic evidence, and tree-ring dates the author places all of them at a time just subsequent to the Classic Chaco and thus as part of the supposed Mesa Verde reoccupation of the Chaco area. A possible criticism here may lie in his failure to consider more fully in this context the well-known and unexplained Sun Temple on the Mesa Verde. The author considers thoughtfully the plausibility of the thesis that these structures may constitute evidence for the intrusion of a Mesoamerican culture influence into the Anasazi area, and while he is not dogmatic on the subject, he remains wisely skeptical.

Not the least of the author's contribution lies in his treatment of the ceramic remains from the Hubbard and Del Arroyo sites. At the former, three building periods and a considerable accumulation of debris provided the opportunity for a meaningful chronology. The excavation procedures here were admirable, and it is gratifying to note that seven depositional layers were recognized and isolated. Furthermore, not merely

was a single trench dug, but four trenches, with the result that an unusually broad view of the stratigraphy was revealed — a circumstance that serves to minimize what otherwise might be erroneous inferences draw from too shallow a profile.

The principal pottery types encountered at both sites were Escavada, Gallup, Chaco, Mancos, McElmo, and Mesa Verde black-on-whites, and a good deal of very helpful descriptive data and discussion are presented for all of these. That the author has not triumphantly penetrated with a blinding flash the taxonomic fog that envelops these important types is not at all a criticism of his effort. He has indeed thrown much light into dark corners and has brought us nearer to an ultimate understanding of them.

The verbal portions of the ceramic descriptions are supplemented by admirable photographs of characteristic sherds of each major type, and the plates provide one of the too-rare instances in which illustrations of this kind are presented at full-scale — a feature that is of great value to any reader in the task of creating a visual image of the original. Enlarged photographs of cross sections of sherds to exhibit variations in paste and temper are less successful and seem to me not very helpful. Incidentally, although the author seems merely to suggest an inference of comparative inadequacy in the use of temper as a distinctive taxonomic criterion for this material, and nowhere explicitly discusses it, he does emphasize that in a "small batch" of sherds of McElmo Black-on-white Anna Shepard identified no less than seven different combinations of temper. I wish that this subject had been pursued further.

There are quite adequate descriptions of masonry, and stone and bone artifacts, accompanied by numerous good illustrations. The volume contains a few typographical errors, though unimportant ones. At least one source mentioned in the text is missing from the bibliography. And despite the technical excellence of the sherd photographs, there are instances in which several sherds from the same vessel have apparently not been recognized as such. But these are very minor faults in a volume of high quality and usefulness to all Southwestern archaeologists.

Watson Smith
Peabody Museum West of the Pecos
Tucson, Ariz.

Excavations in the LoDaisKa Site in the Denver, Colorado, Area. H. J. and C. C. Irwin. Denver Museum of Natural History, Proceedings, No. 8, Denver, 1959. viii + 156 pp., 76 figs., 8 tables. $2.50.

This report describes the results of excavations in a rock shelter located in the eastern foothills of the Rocky Mountains about 15 miles west of Denver, Colorado. It is well illustrated and carefully organized, and offers new information of importance to both Southwestern and Plains specialists on the development of the Archaic in these areas. The bulk of the report is composed of adequate and careful descriptions of the artifacts recovered, together with valuable supplementary discussions of the geology by C. B. Hunt, analysis of the deposits by Robert Rodden, the vertebrate fauna by G. E. Lewis, the flora by W. C. Galinat, and pollen by D. R. Whitehead. There is also a very useful discussion of corn in the Plains area by the Irwins.

Five cultural components were defined within the shelter. From early to late these were: an Early Hunter, Great Basin Lithic, Plains Lithic, Plains Woodland, and Fremont. The report is organized around four of the five defined complexes; the fifth complex, the Early Hunter, is represented only by two Plainview points and a few flakes, and plays a minor role in the discussions. There is also a possibility, not discussed by the authors, that the Plainview points were in reality associated with the overlying lithic complexes. Plainview points consistently occur in Early Archaic contexts in Texas and elsewhere, and there seem to be sound reasons to believe that the type survived well into the Archaic horizon.

The four major complexes are presented as distinct identities occurring as succeeding, or in two cases, possibly synchronous, occupations. According to the authors, these complexes record different ways of life brought to the shelter from culture centers both to the east and west. Thus, the site is seen as a meeting ground between the Plains and Great Basin and affinities to both areas are recognized, but the relative strength of the influences changed through time. Modern ethnographic data are utilized for comparisons, and an attempt is made to present each complex in ethnographic terms.

The earliest major complex is defined as a Great Basin-derived "Desert Culture." In support of this assignment, the authors point to several specific parallels with "Desert Culture" sites in projectile points and other artifacts. They also note, as Jennings observed in his proposal of the "Desert Culture," that there are a number of parallels to Archaic materials to the east and south. There now seems to be general agreement that following the Early Hunter most of the western half of the United States was occupied by hunting and gathering groups who shared a closely similar way of life that, at least initially, included many similar styles of projectile points and other tools. It is to this widespread pattern that the early LoDaisKa hunters and gatherers were affiliated. The point might be raised as to whether it might be a better methodological technique to reserve the term "Desert Culture" to that portion of the pattern which represented a specific economic approach to living in the desert environments. If so, the LoDaisKa Great Basin Lithic would not qualify as "Desert Culture," but could be grouped with this widespread "Western Archaic."

Slightly higher in the shelter was an assemblage of tools called the Plains Lithic. This group is regarded as most closely affiliated with such typical Plains assemblages as Signal Butte I, primarily because of the many specific parallels in projectile and scraper types. There is little doubt that these are later than the tools comprising the "Great Basin Lithic"; however, rather than regard

these as two separate and distinct assemblages with different origins, it is also plausible to consider the materials in the two complexes as recording the development and specialization of the local variety of Plains Archaic.

At still higher levels is a manifestation of Plains Woodland, dated from A.D. 800–1100. Identification here is facilitated by typical Woodland pottery and comparisons with several single component Woodland sites excavated by the Irwins in the same area.

The final complex is the Fremont, defined largely on the basis of nine sherds of Fremont pottery and a small series of projectile points which are similar to Fremont types but not restricted to it. The Fremont and Woodland materials were mixed and it seems likely that the Fremont artifacts were traded to the Woodland inhabitants of the shelter rather than representing a distinct Fremont occupation. At least this interpretation merited consideration by the authors.

These criticisms are, on the whole, relatively minor and do not seriously detract from an over-all favorable impression of the report. Certainly one of its strongest features is the clear and complete presentation of data, which permits the reader to re-evaluate the findings according to his own interests.

FRED WENDORF
Museum of New Mexico
Santa Fe, N.M.

The Central Desert of Baja California: Demography and Ecology. HOMER ASCHMANN. Ibero-Americana, 42, University of California, Berkeley and Los Angeles, 1959. xii+315 pp., 10 figs., 16 pls., 9 maps. $5.00.

This monographic treatment will undoubtedly long be a reference work for the anthropology and geography of West Mexican regions, not only Baja California. It should be especially useful to those interested in fairly recent culture change and the accompanying time-depth factors for peoples living in and coming into Arid America. It covers the subject commendably well and will be a most complete index to the recordings of happenings of the area from about 1700 into the 1950's. Adjustment to aridity by Indians and the later Whites, what happened afterward when small populations were ravaged by epidemics, and when and in what ways caution can be used in interpretation of the Mission records; these themes are woven into most of the text. Localities and provenience of existing documents (or, copies)are given. Some of these are not generally known to all interested in the region: Los Gatos, Benecia, St. Albert's College, University of Texas, Junipera Serra Museum, Carmilla, University of San Francisco.

For archaeologists, there is a summary section (pp. 43–51) of published information on sites, older population areas, and artifacts. Some stone pipes from the Father Castaldi collection (assembled about 1905–46), which was in private hands in Mulegé, are described. Work of Brigham Arnold and William C. Massey is referred to. Functional uses of some types of artifacts, which can be gleaned from descriptions in diaries of the 1700's, are pointed out.

Depletion of plant coverages can be found in Mission and other records; the introductions of bermuda grass and the date palm are documented. There are references to Sonora peoples (such as the Seri and Cáhita) coming to Baja California to work and die.

Clear maps, well-captioned plates, and a full bibliography enhance this work. Coordinated information from the several fields makes this an anthro-geography of much regional value.

ROBERT J. DRAKE
University of British Columbia
Vancouver, B.C.

The Ozark Bluff Dwellers. M. R. HARRINGTON. Indian Notes and Monographs, Vol. 12, Museum of the American Indian, Heye Foundation, New York, 1960. xxiii +185 pp., frontis., 16 figs., 47 plates. $4.50.

This well designed book is a most welcome addition to our knowledge of "The Ozark Bluff Dwellers." It presents the basic data from which resulted the well known article with the same title in the *American Anthropologist* (Vol. 26, pp. 1–21, 1924). Conclusions vary little from those of the original report, but it does give the basis for the conclusions so that they may be evaluated more fully by other students. The book presents site by site the explorations undertaken by Harrington for the Museum of the American Indian in 1922 and 1923. It describes the investigations of shelters on the upper White River and its tributaries in Benton and Carroll counties, Arkansas; the results of researches on Cowskin or Elk River in southwestern Missouri; a float-trip survey of White River in Missouri through what is now the Table Rock Reservoir; and a survey along Buffalo River and the investigation of a few sites in Newton County, Arkansas. It thus appears to contain the information upon which the concept of the Ozark Bluff Dweller culture is founded.

Following a brief introduction, each site investigation is described. Findings are also described, but not always in the detail desirable for comparison with more recent excavations in the same general area.

The chapter near the end of the book devoted to "The Bluff Dweller Culture" is an admirable job of reconstructing the life of the people that inhabited the rock shelters in northwestern Arkansas and southwestern Missouri. Illustrations are excellent.

The book does not solve many questions concerning "The Ozark Bluff Dwellers." For example, evidence for the use and non-use of some items by the "Bluff Dwellers," such as the bow and arrow, does not seem to be conclusive. It does reopen or renew such questions as whether or not horticulture was practiced in the Ozarks by a non-pottery making people, whether split-cane basketry was an early trait preceding pottery in the area, and whether the bow and arrow was strictly post-"Bluff Dweller."

Considering the time that the investigations took place and the long time-span between excavation and analysis and interpretation, this report is an outstanding piece of research. Though late in coming, the book is a valuable contribution to North American archaeology. It is a necessary reference for any student making a study of the archaeology of the northeastern Oklahoma, southeastern Kansas, southwestern Missouri, and northwestern Arkansas area.

Carl H. Chapman
University of Missouri
Columbia, Mo.

Wapanucket #6, an Archaic Village in Middleboro, Massachusetts. Maurice Robbins. Cohannet Chapter, Massachusetts Archaeological Society, Attleboro, 1959. 84 pp., 18 figs., 4 maps, 11 graphs.

From 1939 to 1947 the Middleboro Archaeological Society conducted excavations at Assawompsett Lake. This organization disbanded and the Cohannet Chapter of the Massachusetts Archaeological Society became heir to the work and notes of the Middleboro Society. In 1952 work was resumed and the Cohannet group located Wapanucket #1 on the northern shore of Assawompsett Lake. Subsequently, seven locations along the lake shore were tested and excavated. The present report is primarily concerned with Wapanucket #6.

All work was done by non-professionals under the direction of Maurice Robbins, although occasionally professional guidance was asked for and received. Apparently each excavator kept his own field notes with supervision by the director. In cooperation with professional archaeologists radiocarbon dates were obtained, and for the site under discussion a pit yielded charcoal which produced a date of 4250±300 B.P. A hearth dated 4320 ±250 B.P. at Wapanucket #3 was near a fluted point which is thought to reflect collecting activities of Archaic peoples.

The most significant aspect of Wapanucket #6 is the settlement pattern showing the location of houses, pits, and burials. Five hundred and forty-six postmolds were excavated with several obvious clusters forming circular or semi-circular outlines. Seven clusters are presumed to limit lodge floors, one of which, partly because of its larger size, is thought to be a ceremonial center. The diameter of the family lodges ranges from 30 to 46 feet while the "ceremonial" lodge is 66 feet in diameter. Lodges 1 and 6 are not convincing since they are postulated on the basis of only 16 and 17 postmolds respectively. Robbins is aware of this deficiency and advances their case with caution.

The author asserts that Wapanucket #6 with its lodges, pits, and cremated burials is a single component site of the Late Coastal Archaic. He feels this assumption is demonstrated by artifact typology. I agree that Late Coastal Archaic artifacts are predominant, but disagree that they represent a single component. The Late Coastal Archaic is a multi-component stage with time and space variation. Artifact typology for Wapanucket #6 may belong, if indeed all of it does belong to this cultural stage; but it is not logical to assume a closed site. Several components of the Coastal Archaic could have been responsible for the stone tools found.

Another point in the critical vein is that the report is padded with a section on the Indians of Middleboro of the 17th century. This is a historical subject worth studying but it bears no relation to Archaic peoples. The report would be easier to use if the figures were numbered.

Although I disagree with some of the interpretations presented in this well illustrated work, I am pleased to see local archaeological chapters assume the responsibility of publishing their activities. It is also gratifying to see amateur and professional archaeologists working successfully together.

W. Fred Kinsey III
Pennsylvania State Museum
Harrisburg, Pa.

Sons of the Shaking Earth. Eric R. Wolf. University of Chicago Press, Chicago, 1959. x+303 pp., 56 illus., 12 maps. $5.00.

"Their ground still pulses wtih the seismic shocks that gave them birth . . . The fifth period of time is our own: it will come to an end when the world disintegrates in a cataclysmic earthquake." These excerpts from its first paragraph explain the rather cryptic title of a very excellent book that is identified in small type on the dust jacket, but not on the title page, as concerning "the peoples of Mexico and Guatemala, their land, history, and cultures."

For a succinct statement of the book's contents and orientation one cannot do better than to quote from its preface.

> This book is an attempt to trace the lifeline of a culture. In it I have striven for synthesis rather than for patient anatomy of detail. Writing as a scientist, I here offer a general statement of what anthropologists have learned about one area of the world. Three chapters deal with the geography of Middle America, with the biology of its inhabitants, with its variegated languages. Four chapters trace the prehistoric expansion of its culture; four others explore the altered rhythms of its growth after the impact of foreign conquest. But in writing this book, my aims have also been personal. Middle America has also been a personal experience; and in my writing I have attempted to convey something of the quality of this experience.

These broad and worthy aims are very successfully accomplished to provide in small compass what is certainly the best over-all account of the human history of Middle America from an anthropological point of view that is now available. The time covered extends from the first peopling of the New World up to the present era of increasing industrialization that is bringing about its profound changes just as other events and forces have had their effect in the intervening millennia.

It is a synthesis of an enormous subject confined in a small book, but the treatment is far from superficial. The writing is in a tightly packed style and one is surprised at the amount of information it contains and the fullness of its interpretations. Actually this feature of the book's

being so heavily loaded makes it seem unlikely that it will attract a wide general audience for which, considering the often colorful writing, it seems to have been intended. It is not entirely an easy book to read or at least I expect it will not be easy for those without an anthropological background or some experience in Middle American studies. For those more advanced in these fields, however, it is a valuable and provocative statement of the major events in Middle America's total history and of the natural and social conditions that caused them.

Something over a half of the book concerns pre-Spanish Middle America. In this there are minor points of interpretation one might question, but for the most part the author follows an archaeological and ethnohistoric reconstruction that is now quite standard among workers in the field and there are no serious criticisms to be made. The emphasis is on the interpretation of the archaeology in terms of social and religious organization, as witnessed in settlement patterns, irrigation, population estimates, and in line with this the historical continuum is divided somewhat differently than usual. One chapter entitled "Rise of the Seed-Planters" concerns early man and the first half of what is normally called the Preclassic or Formative Period. The next chapter, "Villages and Holy Towns," covers what is termed the Theocratic Period (900 B.C.–A.D. 750) and thus combines the late Preclassic and the Classic. The dating used favors the Spinden correlation, but there is no discussion of technical problems such as calendric correlations. The following period is named Militaristic and is discussed in two chapters, "Coming of the Warriors" and "Soldiers of the Sun." This naming of periods by terms that are descriptive of supposed characteristic features of the societies of the times concerned gives added emphasis to the kind of interpretation Wolf is attempting. It is my opinion, however, that such terms are *too* descriptive and might perhaps be gross and inaccurate overstatements.

There are no footnotes or references within the text, nor is there a bibliography of the standard kind. There is, however, a 33 page section of "bibliographical notes" containing an extensive coverage of sources and with commentaries on their content and their value as concerns the subjects considered in each chapter. This is very well done and extremely useful, much more to the point in a discursive, semi-popular book of this kind than the full scholarly treatment would have been. There is a good index, but the design and physical appearance of the book do not come up to the standard of its contents.

GORDON F. EKHOLM
American Museum of Natural History
New York, N.Y.

Amerikanistische Miszellen. Festband Franz Termer. Edited by WILHELM BIERHENKE, WOLFGANG HABERLAND, ULLA JOHANSEN, AND GÜNTHER ZIMMERMAN. Mitteilungen aus dem Museum für Völkerkunde im Hamburg, 25, Kommissionsverlag Ludwig Appel, Hamburg, 1959. 206 pp., frontis., 22 pls., 33 figs., 3 maps. DM48.

This volume, published by the Ethnographical Museum of Hamburg, contains 29 articles dedicated to its director, Franz Termer, in honor of his 65th birthday. During a period of more than 40 years, Termer has made many important contributions to the fields of Mesoamerican and South American archaeology and ethnology. There can be no more fitting tribute to this great scholar than this publication. The volume is divided into three sections, the first consisting of three general articles. The second section deals with Middle America to Panama, and contains 20 articles. The third section contains five articles on South America, and one on North America.

Among the articles of general interest, one by José Tudela deals with the origins and diffusion of the chicken and the turkey, throughout the Old and New Worlds. It discusses their sacrificial and religious connotations on both continents and provides evidence that the turkey was introduced to Europe as early as 1507. In the same section Heinrich Ubbelohde-Doering discusses an interesting parallel between ancient Peru and ancient Mexico and Guatemala. The parallel in question comes from the discovery by the author of several pyrite-incrusted clay tablets from Mound 31 at Pacatnamu in northern Peru. The round and square tablets resemble pyrite-incrusted mirror backs from Middle America and the Southwest.

In the second sectoin Franz Blom discusses the pre-Columbian amber trade in Chiapas which was, according to him, a monopoly of the ancient Zinacantecos. Mary Butler's article on "Spanish Contact at Chipal" is of special interest since it clears up an earlier mistake. In 1940, she published a pottery sequence for the Chixoy drainage in the Alta Verapaz based on Burkitt's collections and notes. Among the specimens discussed was one vessel which appeared to have been turned on a wheel. She concluded that it had been made on a *kabal* and, as such, it constituted the only one of its kind ever found south of Yucatán. Since then John Goggin has identified the specimen as a 16th century wheel-made Spanish vessel, probably made prior to 1575. This new evidence places Chipal 3 into the Spanish contact period.

Also in the second section is an article by Carmen Cook in which she discusses and illustrates several interesting figurines from the island of Jaina. Guda E. G. Van Giffen-Duyvis discusses some effigy whistles from Colima, Mexico. A. V. Kidder and Edwin M. Shook present a unique ancient Maya sweathouse excavated at Finca El Paraiso in Quetzaltenango, Guatemala. This unusual circular structure is the only identifiable prehistoric sweathouse from the Highland Maya area. The structure was dated at the very end of the Late Classic period by means of the pottery recovered during the excavation. This date is based on a yet-to-be-described plumbate ware called by Shook "Robles Plumbate," which is intermediate in time between San Juan and Tohil Plumbate. S. K. Lothrop's "Reappraisal of Isthmian Archaeology" is an excellent summary based on the latest radiocarbon dates. In a similar vein, Doris Stone discusses the "Eastern Frontier of Mesoamerica." J. Eric S. Thompson's article deals with the role of caves in Maya culture, their use for religious rites, as depositories of "virgin water"

used in ceremonies, and for disposing of the dead. They were also used to a limited extent as places of refuge and as dumps.

In the third section Herbert Baldus presents a compilation of ethnographic works on Brazil written in the German language, while Thomas Barthel discusses some of the recent ethnographic and ethnological publications on Chile. Of greater consequence is Hans Becher's article concerning the stick duel of the Surára and Pakidái Indians with special reference to the so-called "Nilotic position" and tonsure among these Brazilian groups.

Stephan F. de Borhegyi
Milwaukee Public Museum
Milwaukee, Wisc.

Excavaciones Arqueológicas en San Pablo: Informe Preliminar. Carlos Zevallos Menendez and Olaf Holm. Editorial Casa de la Cultura Ecuatoriana, Guayaquil, 1960. 14 pp., 28 plates, 1 map.

This admirable little publication presents a preliminary statement on the content of a site in coastal Ecuador, pertaining to the Valdivia culture. The excavations described were carried out by Zevallos and Holm in 1959. A complete and detailed analysis of the artifacts from another site of this culture has only recently been presented by Evans, Meggers, and Estrada. The highly distinctive nature of the Valdivia ceramic complex, with its aesthetic elaboration and its combination of a large number of decorative techniques, coupled with the extremely early date (up to 2500 B.C.) that has been assigned to it make the Valdivia culture of unique significance to the understanding of cultural development in Nuclear America. The further data contained in this little report by Zevallos and Holm are thus welcome and valuable.

The cultural material from the San Pablo site agrees in most respects with that from the Valdivia site described by Evans, Meggers, and Estrada. Zevallos and Holm suggest that there are chronological differences among the several different areas of the San Pablo site, but do not present the detailed ceramic analysis which would be necessary to demonstrate such a chronology. In general, the ceramics from San Pablo look as if they belong to the later part of the chronological sequence demonstrated at the Valdivia site and in part even to post-date the end of that sequence. However, the clarification of this relationship will be possible only after a detailed quantitative analysis of the San Pablo material has been published.

The presence of more and better preserved manos and metates at San Pablo than at Valdivia may indicate the introduction or increased importance of agriculture at the former site, though such a contention could be fully proved only by the occurrence of some definite traces of cultivated plants. Nothing of this kind is mentioned.

A far better series of fishhooks was recovered at San Pablo than at the Valdivia site, and Zevallos and Holm discuss these at some length arriving at the conclusion that the hooks were used for fishing in the still waters of bays and lagoons. Their evidence for this conclusion seems both insufficient and inconclusive. They also suggest that only relatively small fish were sought, a proposition that is rendered dubious by the large size of some of the hooks that they illustrate. The degree to which the bearers of the Valdivia culture practiced deep-sea fishing and were thus truly sea-faring people is of great importance to our ultimate understanding of the origins and extent of influence of this unique culture. One should be able to reach an unequivocal answer to this question on the basis of the species of fish present among the osseous remains of the midden. If pelagic, as opposed to littoral, species are consistently an important part of such faunal remains, then some effective form of sea-going vessel must be granted as a part of the material culture of Valdivia. I hope that such an analysis of the species present and of their typical habitat will form a part of the final report. Sometime in the near future detailed comparisons should be made between the shell fishhooks of Valdivia culture and those of various other areas around the Pacific Ocean, as there are close formal similarities not only to those of Coastal Peru and Chile, but also to those of California and Oceania.

Perhaps the single most striking feature of Valdivia culture is the unique style of human figurine which is typical of it. Remains of such figurines were particularly numerous at the San Pablo site and showed a much wider range of variation than had been described previously, though still without approaching any other figurine style known for the New World.

This publication is excellent as a preliminary report. The format is attractive and the illustrations are of high quality. Zevallos is to be commended on his photography which gives one a better feel for Valdivia ceramics than do the illustrations in the Evans-Meggers-Estrada report. The authors have prepared this publication with admirable speed. The final report on these important excavations should be of even greater interest and will be eagerly awaited by all students of South American prehistory. What is clear is that much more detailed and controlled work of the kind reported in this publication must be done in coastal Ecuador before the perplexing problems raised by the discovery of Valdivia culture can be answered adequately.

Donald W. Lathrap
University of Illinois
Urbana, Ill.

The Archaeology of the Lower Tapajós Valley, Brazil. Helen Constance Palmatary. Transactions of the American Philosophical Society, Vol. 50, Pt. 3, Philadelphia, 1960. 243 pp., 12 figs., 121 pls., 6 maps. $5.00.

During her long-continued work on Amazonian ceramics, the author has examined, in Sweden, Brazil, and this country, all the major collections from the Santarém area. With the renewed sponsorship of the American

Philosophical Society, she now presents a companion volume to her study of Marajó pottery published ten years ago. It incorporates extracts from many sources, a lavish number of photographs, some previously unpublished, and further discussion of possible stylistic relationships between the Amazon and other parts of the hemisphere, especially the Mississippi Valley.

The book contains a great deal of useful knowledge never gathered together before, but organized in such a way that it can be extracted only with patience and page-flapping. Illustrations carry no information except dimensions and four- or five-part symbols to aid in tracking down each description in the Stylistic Analysis, a 59-page outline in which the objects follow a different sequence. Present locations and catalogue numbers appear in a separate table keyed to the plate numbers. Classification of the pottery primarily according to the form of bottoms or feet, if any, results in placing dissimilar pieces side by side and separating others that could safely be grouped together by shape and decoration.

As text and illustrations demonstrate, what is called Tapajó or Santarém pottery is by no means a single homogeneous style. Plates 21, 30, and 36 give a fair sampling of the exuberantly modeled forms generally considered typical. These complex vessels rarely exceed 20 cm. in height. Gingerbread ornament is combined with simple incised patterns, leaving no empty space for painted patterns, though a few pieces retain traces of fugitive paint. Plates 14, 19 *a*, *b*, 22, 46, 48, and 53 represent examples of a contrasting type, likewise ceremonial rather than utlitarian. These vessels, frequently two or three times as large, are far simpler but more varied in form. Modeling and incising are handled with restraint even when used for motifs identical to those on ornate examples. Nearly all appear to have been painted, in red and black on white slip, black on red, or red on buff; the three-color geometric patterns have considerable sophistication. Various individual vessels represent, I believe, a transition from the painted to the modeled type.

The author rightly distinguishes several "Non-Tapajó Wares." The one characterized by pitted decoration of surfaces and adornos is called Konduri, a general term Hilbert has adopted from Nimuendajú to describe both decorated and utilitarian types predominant at sites northwest of the Santarém area, mostly north of the Amazon along the Trombetas and Jamundá tributaries. The statement attributed to Hilbert on page 66 needs clarifying; his excavations produced a sand-tempered ware amounting to 5% of total sherds, but he did not include this with Konduri, which is tempered with siliceous-sponge spicules. The author's Type XXIV–B, "Ware Having a Rough Surface and Geometrical Decoration," seems to be the same as Hilbert's *Estilo globular*, a sponge-tempered ware of Barrancoid appearance with modeled adornos and wide and narrow incised lines.

Other students would have welcomed a resumé of stylistic characteristics and a summary, but the sections so named are devoted to correlation. A chart that compares Santarém ceramics to those of 19 other areas, showing close relationship with the Mississippi Valley, raises doubts immediately by showing almost none with the other bank of the Amazon. Although the Amazonian styles are as yet loosely defined, the modeled Konduri resembles Santarém so evidently that only technical criteria can determine the style of certain examples.

Ceramic techniques, as significant as stylistic traits and extraordinarily advanced at Santarém, deserve more attention. Two valuable microscopic examinations are described fully and the fragments illustrated. While the quotation from Linné on page 27 implies the use of siliceous-bark temper, I have found no evidence in his works or elsewhere of any other temper than sponge spicules in Santarém pottery. The author notes the application of white *tabatinga* clay as a slip; this material, however, appears only on polychrome, not on the ornately modeled vessels, which have a fine-textured buff surface. Both types were polished, and the painted pieces sometimes retain resin varnish. Another distinctive trait was the method of attaching adornos, bases, and necks by first scoring the main body of the pot. The complexity, color, and hardness of the pottery indicate firing in a self-consuming kiln that provided a temperature of at least 900°C. and a reducing atmosphere followed by an oxydizing one.

The section on lithic art draws upon the invaluable studies of Barata. His description of the 13 stone sculptures or idols now known (in *As artes plásticas no Brasil*, 1952) should have been mentioned, since only three of them are illustrated here. Most nephrite pendants of an important class, representing frogs, recall the celt form; there are also small plain celts of the same material, including one in the University Museum, Philadelphia (30–37–1), a rare example in this country of the distinctive yellow-green Brazilian nephrite. In addition to the lapidary tools and techniques included, I have seen clear indication of cord sawing on both pendants and larger sculptures, and small stone drill points, but nothing to confirm the use of tubular drills.

Chronological problems are never raised, but neither the field archaeologist nor the art historian can escape them. The author seems to imply that all the artifacts are roughly contemporaneous, and attributable to the various tribes occupying the region at the time of European contact. Although this assumption may prove correct, certain ceramic variations may, on the other hand, reflect temporal differences. The pottery itself, and evidence from archaeological investigations at the mouth of the Amazon, along the north bank opposite the confluence of the Tapajós, and at other sites upriver and in the Orinoco basin, suggest successive occupations of the Santarém area and ceramic development during the principal one from a painted to a modeled style.

Elizabeth Kennedy Easby
Museum of the American Indian
New York, N.Y.

NOTES AND NEWS

Edited by Nathalie F. S. Woodbury

INQUA MEETING IN POLAND

The International Association for Quaternary Research (INQUA) will meet in Poland during the late summer of 1961. The Congress, which meets every four years, will be preceded by an excursion starting from Warsaw on August 27. The first meeting of the Congress will take place on September 2 and the last meeting on September 7. A post-Congress excursion will be held from September 7 to 21 and will visit the main localities containing Polish Quaternary deposits.

INQUA was first organized during an international geological meeting in Copenhagen in 1928 for the purpose of approaching Quaternary problems on an interdisciplinary level particularly in the fields of geology, archaeology, climatology, and chronology. Although the Congress has been attended primarily by Europeans, it is international and non-Europeans are urged to attend.

It has been the desire of many Europeans and Americans to hold the Congress in the United States sometime in the future. To this end the National Academy of Sciences–National Research Council created a U.S. Committee on INQUA. This Committee is making plans to invite the next Congress to meet in this country during the late summer of 1965. Terah L. Smiley, Universtiy of Arizona, is vice chairman of the committee and AAAS representative. J. Charles Kelley, Southern Illinois University, is SAA and AAA representative.

All persons interested in the 1961 Congress in Poland may obtain more detailed information by writing to: Professor Rajmund Galon, Secretary General, INQUA, Geographical Institute, University, Torun, Poland.

CONFERENCE ON HISTORIC ARCHAEOLOGY

Workers in the field of historic site archaeology have recognized for some time the need of a conference in their field. The first such meeting, arranged by Stanley A. South, North Carolina Department of Archives and History, was held November 3, 1960, at Gainesville, Florida, in conjunction with the Southeastern Archaeological Conference and consisted of the following papers: Spanish Beads of the 16th and 17th Centuries (John Goggin), The Ceramic Types at Brunswick Town, North Carolina (South), English Glass Wine Bottles of the 17th and 18th Centuries (J. Paul Hudson), Ceramics of New Echota, Georgia (Charles H. Fairbanks), A Method of Cleaning Iron Artifacts (South). A discussion of mid-18th century glass beads was led by Goggin. The papers will be published by the Florida State University in *Notes in Anthropology*. The Conference on Historic Archaeology will meet in 1961 at Ocmulgee National Monument, Macon, Georgia, on the day preceding the Southeastern Archaeological Conference. Persons interested in participating should contact Stanley A. South, Archaeologist, Brunswick Town State Historic Site, 225 Pine Grove Drive, Wilmington, North Carolina.

GREAT BASIN

The Great Basin Conference scheduled for September 9–10 on the University of Oregon campus, Eugene, Oregon was canceled because of insufficient response to build a program. Chairman Luther Cressman has asked Jesse Jennings, Clement Meighan, and Phil Orr to serve as a committee to make recommendations for a program and officers for 1961. The committee will also consider the desirability of holding annual meetings and other matters concerning the future of the Conference.

Utah. In August a University of Utah field party completed a survey of the El Paso Natural Gas Company pipeline right-of-way running from Thistle, Utah, to the Nevada-California border. Results of the reconnaissance were largely negative with only 16 sites, mostly surface chipping stations, recorded. The paucity of prehistoric encampments is surprising, since the right-of-way crosses several streams and passes near areas known to have been heavily populated in aboriginal times. Further examination of the pipeline route will be undertaken when ditching begins.

A brief examination of two dry caves in the Fish Springs National Wildlife Refuge, Juab County, Utah, was made in September with inconclusive results, although the association of the caves with lake terraces and their depth of deposit suggest considerable antiquity. More work is planned for this area in the near future.

Members of the Utah State Archaeological Society assisted testing at a site near Brigham City last September. The presence in the deposit of large quantities of buffalo bone, evidences of circular semisubterranean structures, and projectile points and pottery similar to materials from the Promontory Caves, suggest that the occupation may be related to the Dismal River aspect of the western Plains. Additional excavation, including examination of the structural remains, was scheduled for the fall of 1960 and the following spring.

Nevada. The Nevada State Museum's summer archaeological program included excavations in rockshelters at Rainbow Valley, east of Fallon, Nevada, and at the northern end of the Carson Sink. The shelters proved to have shallow refuse accumulations but yielded projectile point forms indicating occupation by recent Paiute Indians as well as by an earlier people. The missile points of the latter population resemble those found at Lovelock Cave and in caves near Winnemucca. Excavations are continuing in a series of dry caves and rockshelters located at the northwest end of Lake Winnemucca. These sites have produced extensive perishable materials, similar to those found at Lovelock.

Investigation by the Museum of Deer Creek Cave, 4 miles north of Jarbridge, revealed 11.5 feet of cultural deposit in the cave. Moisture had destroyed all perishable materials but the midden was extremely rich in projectile points. Samples for radiocarbon dating were obtained from five hearths uncovered at different levels.

A series of well-defined Lake Lahontan terraces, located just west of Lovelock, are being used in a pilot study of past climatic history of the Humboldt Basin to link ancient shorelines to local archaeology. Trace element and pollen analyses will be applied to tufa samples from established elevations along the shore lines and, if significant information is obtained, some tufa specimens will be radiocarbon dated.

CALIFORNIA. Claude Warren of the University of California (Los Angeles)Archaeological Survey, assisted by D. L. True and Fred Reinman, excavated a small rockshelter in Imperial County during the spring of 1960. The wooden artifacts, including a pottery paddle, arrowshafts, and a fire drill, as well as cordage, lithic tools, and pottery are attributed to a late Yuman occupation.

A two-man field crew from UCLA, consisting of Gordon Grosscup and Jack Smith, surveyed the California stretch of the El Paso Natural Gas Company pipeline right-of-way mentioned above. Eighteen sites, five of which had already been recorded, were located along the pipeline route which runs across Troy Lake, through Cronise Valley, Soda Lake, and Yucca Grove. Two sites on Soda Lake were ascribable to a Lake Mohave occupation. The remainder were either petroglyphs (4), late pottery and small point sites (6), or could not be placed chronologically (5). Possibly as many as seven of the sites were situated on the right-of-way or near enough to it to be disturbed by construction work. None of the eighteen showed any indication of depth.

Assembled by WILLIAM J. WALLACE

SOUTHWEST

PECOS CONFERENCE. The 1960 Pecos Conference, held at the Research Center of the Museum of Northern Arizona, Flagstaff, and chaired by Edward B. Danson, was attended by 203 registered participants. The program, arranged with the assistance of Alan P. Olson, included field reports in archaeology, ethnology, and linguistics, and a symposium on "Land Use and Settlement in Arid Environments." The conference accepted an invitation sent by Ignacio Bernal, to meet in Chihuahua City with the 1961 Mesa Redonda. Charles C. Di Peso was elected chairman of the interim committee.

NATIONAL PARK SERVICE PROJECTS. *Wetherill Mesa.* At the completion last summer of the archaeological survey directed by Alden Hayes of the flanks and top of Wetherill Mesa, 795 sites had been recorded. The speedy survey of the forested mesa top was made possible by the use of radio direction finder equipment for locating the ruins. Work in Long House and Mug House, resumed in mid-April, resulted in about 80 rooms as well as 19 kivas and 40 burials excavated in Long House, and 53 rooms, three of the four kivas, and 39 burials in Mug House. Limited testing in a cave site and agricultural terrace area was done by J. Anthony Pomeroy. Robert F. Nichols, from the Laboratory of Tree-Ring Research at the University of Arizona, was assigned to the project as dendrochronologist. Pollen and ecological studies are also being conducted. Stereo photographs have been made of the three major ruins in order that sections of them may be mapped photogrammetrically.

Upper Colorado River Storage Basin. On the Glen Canyon Dam Section the staff of the Museum of Northern Arizona Glen Canyon Project, directed by Alexander J. Lindsay, surveyed and excavated in the lower portions of the San Juan and Glen canyons from April through September. Surveys were made adjacent to and northwest of Navajo Mountain, along the western border of Monument Valley, on Cummings and Paiute mesas, and in the canyon systems proper. Excavations were made at selected sites along the Colorado and San Juan rivers and in the impoundment basin. New data for the Kayenta Anasazi from the southern half of the Glen Canyon Basin are worth noting at this time. Irrigation systems of stone-lined ditches, windbreaks, and terraces are found along the San Juan River and the highland regions outside the master canyon associated with small communities occupied between A.D. 1050–1250. Scattered pueblos, in the open or sheltered by cliffs and ledges, occasionally accompanied by a kiva and shallow trash deposits, are the usual pattern. This is somewhat at odds with the concept of large cliff dwellings believed common to the area during this period. Petroglyphic art throughout the basin has been analyzed by Christy G. Turner II into five styles: (1) 1850–present, Navajo-Paiute and Anglo; (2) 1350–present, Hopi; (3) 1200–1300, Kayenta Anasazi (late Pueblo III); (4) 1050–1250, Kayenta and Mesa Verde Anasazi (Pueblo II–III); (5) pre-1050, Anasazi (Basketmaker and Pueblo I). Some of the post-1050 designs may be derived from the Hohokam and Mogollon culture areas, while some of those made before 1050 may belong with the Desert Culture.

During the 1960 field season of its Glen Canyon project, the University of Utah excavated 20 sites in Lake Canyon which included both shallow dune occupation areas and deep stratified deposits indicative of occupation during Pueblo II and Pueblo III. Robert H. Lister directed testing of 44 sites in Steer Pasture Canyon, Castle Creek Canyon, Cedar Mesa, and the Escalante area, twelve of which were recommended for excavation to sample the occupation of these areas from Basketmaker III through Pueblo III. A preliminary survey of the Flaming Gorge Reservoir by David S. Dibble and Cal Porter yielded 63 sites ranging from surface lithic concentrations to possibly stratified ceramic sites.

The acceleration of construction activities at Navajo Dam has resulted in a corresponding expansion in the salvage program on this section of the Upper Colorado River Storage Basin. The earliest site investigated during 1960 represented the Los Pinos phase of Basketmaker II, containing structures with cobblestone aprons which are typical along the Pine River in New Mexico and Colorado. In one instance, an earlier Basketmaker II structure, identical with those at Durango, Colorado, was found underlying one of the cobblestone aprons. Excavation in a large Piedra phase village produced the total range of known Piedra phase artifacts and architecture, as well as heretofore unknown variations such as fish- and duck-effigy jars, duck-effigy pendants, and fish and

duck skeletal material. At this village a big kiva, 42 feet in diameter, was excavated, in addition to 14 large pit houses, eight small pit houses, and a large number of surface structures and subsurface ovens. The number of vessels obtained permits an accurate definition of Piedra phase pottery in this district. One pit house alone produced 55 restorable vessels.

An experimental course in salvage archaeology, conducted by Fred Wendorf for the Museum of New Mexico in cooperation with the Fort Burgwin Research Center, was financed by a grant from the National Science Foundation under its program of experimental training projects. The course included excavation of three sites in the Navajo Dam area also belonging to the Piedra phase.

Navajo Dam Project excavations in three caves and three open sites of the Navajo period produced material ranging in time from possibly the earliest Navajo remains in New Mexico through the Gobernador phase. Earlier levels in the caves contained cists which should date from the Rosa phase, one with a mummified infant burial wrapped in fur cloth. Some of the cists, apparently in use also during the Navajo period, contained Navajo perishable items, until now relatively unknown, including sandals, a basketry fragment, and a clay pipe. A survey has been completed of the construction area of the Hammond irrigation project along the San Juan River near Bloomfield, New Mexico, where excavations are planned for winter and spring, 1962. The area of one site alone is comparable to that of Aztec Ruin.

Other National Park Service Projects. Wilfred Husted, a graduate student at the University of Colorado, has made an archaeological survey of Rocky Mountain National Park under the direction of Robert H. Lister. Philip M. Hobler, a University of Arizona graduate student, surveyed 45 square miles of Natural Bridges National Monument for the Park Service; 80 sites, mostly rock shelters, were recorded, virtually all of them Pueblo II. Among the more interesting finds were 12 kivas, most of them rectangular or D-shaped, with complete or nearly complete flat or cribbed roofs. At Montezuma Well, Montezuma Castle National Monument, Park Service Archeologist Edmund J. Ladd excavated seven post-1300 room outlines. Archeologist Michael Moll excavated rock outlines in Walnut Canyon National Monument, which appear to have been use areas of some sort, with associated pottery. With completion of the Chaco Canyon survey salvage work has been recommended for five sites. R. Gordon Vivian has begun clearing and stabilization of the large Una Vida ruin in Chaco Canyon National Monument. Charlie R. Steen spent part of the summer in Helsinki studying the Nordenskiöld collection from Mesa Verde.

Arizona. Arizona State College, Flagstaff, surveyed in June, 1960, several proposed reservoir areas and dam sites in northern Arizona at the request of the Arizona Power Authority and the Navajo and Hualapai Indian tribes on whose reservations the dam sites are located. An intensive survey in the lower Little Colorado River area, between Grand Falls and Leupp, recorded 140 pueblo sites representative of the Kayenta and Winslow branches of the Anasazi culture and also of the Sinagua culture from Basketmaker III through Pueblo IV. The data indicate a heavy population of the valley by people farming the banks and living in permanent habitations on the terraces above. Contacts with people of the upper Little Colorado as far east as Zuni and the Chaco branch territory appear to have been virtually continuous. An eastward extension of the Sinagua branch across the Little Colorado River is postulated. For 7 miles up Moenkopi Wash from its confluence with the Little Colorado River, a second survey located 26 Kayenta Anasazi sites ranging from Basketmaker III to Pueblo IV. Robert C. Euler was in charge of both of these surveys. In addition, Euler made a 312 mile trip down the Colorado River by boat in a preliminary survey of the proposed Marble Canyon dam site on the Navajo Indian Reservation and the Bridge Canyon dam site on the Hualapai Indian Reservation. Only six sites were added to the six previously reported by Walter W. Taylor.

The Chicago Natural History Museum Southwest Expedition, with headquarters in Vernon, Arizona, worked for four months in 1960 in east central Arizona. Nine students assisted Paul S. Martin and John B. Rinaldo. Two important research projects were made possible by a grant from the National Science Foundation: (1) palynological investigation of prehistoric plant geography and geological stratigraphy as a possible aid in understanding the ecological aspects of Mogollon culture history, and (2) archaeological survey and excavations in the upper Little Colorado River drainage to solve problems of local culture development and determine relationships between prehistoric Mogollon cultures and the historic western Pueblo cultures. For the palynological project 270 samples of sediment were gathered from arroyos and archaeological sites at levels dating roughly from 700 to 4000 years ago. Preliminary results should be issued by late spring, 1962, by the Geochronology Laboratories of the University of Arizona. The archaeological survey added 65 new sites to the inventory previously recorded by the Museum. Martin and Rinaldo feel that, in addition to providing other necessary information, the survey produced clues as to origin and distribution of the Snowflake subculture. Three prepottery pit houses and three associated storage pits were excavated. The assemblage of stone artifacts appears to be related to the Concho complex. Charcoal from one pit house has been dated by Groningen (1960) at about A.D. 360 (1600 ± 50 B.P.). Digging was also resumed at Hooper Ranch Pueblo where a large rectangular great kiva with a ramp entrance was excavated. A crypt in the floor near the south vault contained a painted human figure of sandstone and a tiny pottery jar with a few beads. The figure may represent an ancestral cult deity or a proto-katchina. (See *Science*, Vol. 132, No. 3425, p. 458 [19 Aug. 1960].) The guess date on the Great Kiva is A.D. 1250–1325. At this pueblo 24 surface rooms and five pit houses were also dug.

The Museum of Northern Arizona, at the request of the Navajo Tribe, has been excavating on the Navajo

Indian Reservation. Under the field direction of J. Richard Ambler, 14 sites were tested on a portion of Navajo Route 1, between Tuba City and Kayenta. The sites ranged from Basketmaker III to contemporary Navajo, although the majority were occupied during the last part of Pueblo II and early Pueblo III. The largest of these sites was occupied during Basketmaker III and Pueblo III. The earlier occupation was marked by large, shallow, circular pit houses, some with bulbous entries. The later and more extensive village was composed of small, dirt-walled pit houses, rectangular in plan and nearly twice as deep as the earlier structures. A number of irregular masonry storage areas, a circular masonry-lined kiva with a southern recess, and an extensive trash area were associated with the late occupation. This is the first extensive excavation in a village of this type, confirming the indications found on the Four Corners Pipeline Project of Pueblo III pit houses in the Klethla Valley. Excavation of a small site of the Padre phase was completed by Thomas A. Lee, Jr., in the Turkey Tanks vicinity, about 15 miles northeast of Flagstaff. A three-room masonry pueblo and two deep, rectangular, masonry-lined pit houses were cleared. Although kivas have not been described for this phase, the ventilator complex, a raised platform in one end of one of the pit houses, and the spatial relationship of the pit structures to the surface units suggests the possibility that the pit structures may have been kivas. Testing of a large alcove shelter in Three Turkey Canyon, just south of Canyon de Chelly National Monument, done at the request of the Navajo Tribal Park Commission, resulted in excavation of one room in a two-story Pueblo III masonry structure and a trench 3.75 m. deep in the fill of the cave. Eight fragmentary burials were encountered, two in the trash from the later occupation. The remainder, assigned to Basketmaker II, were found in a disturbed zone 1.5 m. below the present surface, without associated pottery. The six deeper burials were accompanied by *Olivella* shells, disc beads, and traces of organic material.

In September the Arizona State Museum undertook limited salvage archaeology in the officers' row portion of the Fort Lowell ruin, Tucson. This work, directed in the field by Alfred Johnson, was done in cooperation with the Pima County Parks and Recreation Department and the Arizona Pioneers' Historical Society with labor provided by the county. One complete set of officers' quarters was excavated, and commanding officer's quarters were extensively tested. The information obtained will be used for reconstruction.

The Arizona Antiquities Act of 1960, passed last spring by the legislature, amends flaws in earlier legislation, is considerably more specific, and contains several additional features: (1) it specifies that only professional institutions may be granted permits to explore; (2) it gives authority to the Director of the Arizona State Museum to establish regulations under which permits may be granted; (3) it requires that any antiquities encountered during survey or construction by state or local government agencies, or contractors working for them, be preserved by them and be reported to the Director of the Arizona State Museum; and (4) it makes unlawful the manufacture or sale of fakes or the sale of artifacts known to have been obtained illegally. Copies of this act may be obtained from William W. Wasley, Arizona State Museum.

The 15th session of the University of Arizona Archaeological Field School at Point of Pines, June 17 to August 12, was attended by 18 graduate and undergraduate students from nine colleges and universities in this country. The work was directed by Raymond H. Thompson. Alfred Johnson was dig foreman; Roy L. Carlson and James Neely, assistant dig foremen. Wilma Kaemlein supervised the laboratory activities. A crew of from seven to 25 Apache laborers was employed with funds from a National Science Foundation grant. Additional work at the Turkey Creek site (Arizona W:10:78) consisted of further testing of trash deposits for burials. The 37 burials excavated bring the total recovered from the site to 250. Work was concentrated on two sites, the Lunt site (Arizona W:9:83) and the Stove Canyon site (Arizona W:9:10), in an effort to obtain information for the period from about A.D. 600 to 900, the least known portion of the Point of Pines sequence. The Lunt site is a pit-house village of the latter part of the Dry Lake phase (800–900), and may span the transition between this phase and the Nantack phase (900–1000). Several small masonry structures of Reserve phase (1000–1100) overlie the earlier pit-house village. The pit houses which were dug into bedrock, are generally square with rounded corners, eastern entrances, and six-post roof support. Important pottery intrusives are Red Mesa and Kiatuthlana black-on-white; local types include Nantack Red-on-brown. Fourteen pit houses, four masonry units, nine burials, two storage pits dug into bedrock, and about 1400 meters of trenches were excavated. The Stove Canyon site has an early occupation, which dates from about A.D. 650 to 750, overlaid by a small Reserve phase pueblo. The earlier occupation may represent a new phase in the Point of Pines sequence, the Stove Canyon phase (600–900). This early component consisted of a pit-house village with a large square great kiva. The houses, again dug into the bedrock, are more or less square with rounded corners, variable entrance orientation, and generally a two-post roof support. The great kiva fills in the only gap in the long sequence of great kivas at Point of Pines. The most abundant intrusive pottery types are Gila Butte and Santa Cruz red-on-buff. A north-south, or Casa Grande, type ball court with rudimentary end courts and a center marker appears to be associated with the Reserve phase component. Sixteen pit houses were excavated and another was outlined; the great kiva and two bedrock storage pits were cleared. The ball court was extensively trenched, and three masonry rooms and five burials were excavated.

At the Geochronology Laboratories of the University of Arizona the pollen-stratigraphic study of various sediments containing cultural remains is yielding new information on the paleo-ecology of the Southwest. A series of ten pollen diagrams constructed by Paul S. Martin and James Schoenwetter will form the basis for a postglacial

pollen chronology of southern Arizona. Seven of these diagrams represent material associated with Cochise cultural horizons including the type localities of the Sulphur Spring and Cazador stages at the Double Adobe site. Results of the pollen analysis can be used both in the geologic dating of the deposits and in the interpretation of climatic conditions during the period of human occupation. Martin and Schoenwetter have reported an early record of maize pollen from the Cienega site at Point of Pines (*Science*, 1960, Vol. 132, pp. 33–4). This pollen came from sediments associated with Cochise cultural remains, and thus far it represents the oldest record of corn pollen in Arizona, roughly contemporaneous with that of Bat Cave and other Chiricahua stage sites in New Mexico. Room fill from Long House in Mesa Verde proved rich in corn pollen with occasional grains of cucurbit pollen. An analysis by Schoenwetter revealed a very high frequency of a type of pollen from Long House which may be the Rocky Mountain bee plant, *Cleome serrulata*. It accounts for as much as 80% to 90% of the pollen spectra in fill of Pueblo III age. Possibly prior to the pueblo abandonment *Cleome* served as an important "starvation plant," akin to its use by the modern Hopi. Analysis of kiva fill in Chaco Canyon, from the kiva excavated by Joel Shiner, served to determine when corn cultivation ended, but yielded no clear cut evidence of climatic change. Most archaeologists scrupulously save soil samples from stratigraphic profiles in their excavations, a practice which should continue. Usually 5 cc. of a soil sample is more than adequate for pollen analysis.

William G. McGinnies, formerly Director of the Central States Forest Experiment Station, Ohio, was appointed director of the University of Arizona's Laboratory of Tree-Ring Research in July, 1960. McGinnies has also been named coordinator of the Arid Lands Research Program at the University of Arizona. Bryant Bannister is in charge of the Laboratory's archaeological research program, and David A. Breternitz, graduate research assistant, is reorganizing the extensive archaeological tree-ring collections. Projects recently completed by the Laboratory include: (1) study of a large number of tree-ring samples from Navajo sites in and adjacent to the Navajo Indian Reservation, as a part of the Navajo Land Claim Project (Terah L. Smiley and Marvin Stokes); (2) a compilation of 828 dates representing 46 sites in the Chaco Canyon, Chacra Mesa, and Sisnathyel Mesa, as a part of the Chaco Canyon Region Project (Bannister). Nearing completion is a study of tree-ring specimens excavated from late prehistoric sites of the Flagstaff area, representing the Northern Arizona Project (Thomas Harlan). Projects under way include: (1) a study of the tree-ring material from Wetherill Mesa in Mesa Verde National Park (Robert F. Nichols); (2) the dendrochronology of the Casas Grandes Project (Stewart Scott); and (3) a study of tree-ring specimens from the Navajo Dam area (Thomas Lee).

The 1960 University of Illinois summer field session, directed by John C. Mc.Gregor, excavated for a second season in the Pershing site, a late Pueblo I and very early Pueblo II Sinagua Village on the Pollock ranch 40 miles southeast of Flagstaff. Presumably almost all of the village has now been dug, with 17 structures completely excavated. The occupation of the site spans the time of the eruption of Sunset Crater, but the site lies outside of the cinder fall area and for this reason does not show the usual cultural break that took place in the cinder fall region. The finding of a second large structure, presumably a kiva because of its size and the presence of peculiar long wall trenches, possibly floor drums, was one of the most interesting results of this season's work. These two large structures, one found each season, are almost alike, although the presumed later one is slightly smaller than the earlier example. They are pit structures with bowed sides and slightly rounded corners. Other interesting features are two large cistern-like pits, 4 feet in diameter and some 6 feet deep, which contained burials in the fill. They suggest large storage pits but are of far greater size than any previously found in the Sinagua culture. The settlement pattern indicates that this was a small, compact village with what appears to have been an open plaza-like area.

Chihuahua. The Joint Casas Grandes Expedition now in its third field season has developed a phase sequence, the earliest horizon of which is like the Mogollon culture to the north, with pit houses around a large circular ceremonial room. Burials occur at random at the sites. The lithic complex is similar to that described by Lister in his Chihuahua cave studies of 1958. It is believed that village settlement patterns proceed from crude village farming communities to house clusters and eventually to the high urban centers represented at Casas Grandes. In its great period of construction, which included ball courts, truncated mounds, and other ceremonial structures, there were also a large city plaza, a city water system, and staircases both inside and outside a multi-storied structure. These are indicative of an architectural sophistication not suspected at the beginning of the project.

New Mexico. Excavations were continued during the summer of 1960 at the Pot Creek Ruin, Fort Burwin Research Center, under the field supervision of Ronald Wetherington. A ceramic and architectural sequence similar to that for the Santa Fe district, can now be demonstrated for the Taos area: an early period characterized by black-on-white pottery and pit houses prevailing as late as the 1100's, architecturally and ceramically similar to the Chaco and Little Colorado areas, and a later ceramic complex closely related to Santa Fe, combined with above-ground, multi-storied, adobe-walled pueblos and associated kivas. A great kiva, 50 feet in diameter and averaging 6 feet deep, with a central fire pit, two floor drums, a ventilator on the east side, and a 6-post roof support pattern was uncovered at Pot Creek. Other projects involved digging deep circular pithouses characteristic of the northern Rio Grande architectural pattern, excavating an early 19th century Spanish farm house, and commencing a geographical and archaeological survey of the Taos area.

Museum of New Mexico highway salvage is now under the supervision of Jim Sciscenti. Last year's work was largely survey, except for excavation of a small Galina phase structure. The United Pueblo Agency has agreed that salvage operations may be undertaken on all new roads constructed within its jurisdiction. Preliminary plans have been approved by the State Highway Department for a complete inventory of archaeological sites in New Mexico.

A grant from the School of American Research enabled the Museum of New Mexico to make a cave survey and excavations in the Alamo Hueco Mountains of southwestern New Mexico. The field work was done by Richard Ambler, University of Arizona graduate student, under direction of Marjory Lambert of the Museum. Ambler dug in three caves, one of which may have been a ceremonial place. In it were found a hunting net woven entirely of human hair, the largest of this type ever recorded, a net-repair kit containing human hair, and a carrying basket containing animal tails and fur. Also found were a painted wooden kachina, a finely woven bag containing a stone pipe with bone stem, and a number of perishable items.

The University of New Mexico, with a National Science Foundation grant, recorded some 200 new mural paintings from the kivas at Pottery Mound. Russell Schorsch was in charge of the field work under direction of Frank C. Hibben. Eight painted kivas have now been processed and the paintings recorded. The Pottery Mound murals will be one of the best sources of ethnological and artistic information on the prehispanic Southwest. Many of the paintings are extremely elaborate in drawing and color and suggest close association with the Hopi area and the paintings at Awatovi.

Florence Hawley Ellis, University of New Mexico, conducted a second summer field school at the Yunque site on the outskirts of San Juan Pueblo 30 miles north of Santa Fe. The party was divided so that work could be begun at Sapawe, a Pueblo IV site near El Rito. The latter is probably the largest adobe walled ruin in New Mexico and is certainly one of the largest in the Southwest. The 1960 work at Sapawe involved only one of the seven plazas, where a point of unusual interest is evidence of an arcade supported by posts around a considerable portion of the interior. Excavation in one kiva indicated a deep structure with wooden roof supports rising from the bench and east ventilator shaft. Preliminary sherd analysis indicates a short occupation during the period of Sankawi Black-on-cream and contemporary wares. San Juan legend has Sapawe occupied by the Keresan ancestors of Cochiti Pueblo, before they were driven from the area (according to Cochiti tradition) by the Tewa. Excavations at Yunque were concentrated in the east mound and adjoining areas. The 1959 work indicated that this portion of the site continued to be occupied by Indians after the first Spanish settlers had taken over the west mound area buildings as barracks, probably in 1599. Indian ceremonial items and pottery, and such Spanish trade pieces as three-legged metates were uncovered here in both 1959 and 1960, as well as a number of burials in the trash to the east. The find of special interest during 1960 was a small subsidiary village of typically Spanish stone-based walls (contrasting with the clay Indian walls) to the north of the east mound. These rooms, found beneath a field that has been cultivated for generations, were combined into one, two, and three room apartments, indicated by the arrangement of doors between rooms. One may suppose it was here that the families who accompanied Oñate lived. In some of the rooms low, stone covered "tables" provided some slight convenience in preparing food or served as a base for charcoal cooking fires. Indian trough metates had been sealed into metate rests (as opposed to the typical pueblo "mealing bins") in two rooms, and fragments of a three-legged Mexican style metate were found in a third. Vessels in the rooms, as might be expected, were of Pueblo manufacture, but in one room a very fine high relief religious medal dating from the early 1600's was found, and outside the doorway of another room were several handfuls of the brass linked decorative portions of Spanish chain mail (identified by Arthur Woodward). Numerous fragments of metal occurred in the rooms, and in one fire pit was a fragment of old handblown blue glass. Spanish material from this site, which the Spanish christened San Gabriel, is being examined by E. Boyd of the Museum of New Mexico. At least another season will be required to complete the excavation of this village.

UTAH. The Department of Anthropology at the University of Utah excavated a late Pueblo II-Pueblo III site of the Virgin branch near Santa Clara, Utah, which has contributed to knowledge of relationships between the Virgin branch and other areas of southern Utah, as well as of Virgin branch pottery types. The University of Utah has initiated a cooperative program with the University of California at Los Angeles for research in the archaeology of the Arizona Strip. Additional work at Antelope Cave and a survey of portions of the Strip were undertaken in 1960.

On May 21, 1960, the first annual meeting of the Utah Statewide Archaeological Society was held on the University campus. This meeting was the culmination of five years of development and organization of an archaeological society in Utah. It is anticipated that this will mark the beginning of increased amateur participation in the archaeological program of the Department of Anthropology.

The Department of Anthropology and Sociology, University of California (Los Angeles), held the sixth session of its archaeological field school in Cedar City, Utah, with the College of Southern Utah again acting as host institution. The session, directed by Marshall McKusick, lasted from June 20 to August 1, 1960, with approximately 40 undergraduate and graduate students enrolled in the field course. Two Puebloid sites were investigated and a series of structures were excavated.

Assembled by WILLIAM W. WASLEY

PLAINS

This issue summarizes, mainly, the field work carried out in the Plains area during the summer, 1960, through September 1.

Alberta. The Glenbow Foundation field parties operated in various parts of the province under the general supervision of Richard G. Forbis. Investigations of a blowout near Redwater on the North Saskatchewan River and of a campsite on the Oldman River yielded substantial collections of artifacts. In the Calgary district a large bison scapula with a projectile point fragment embedded in it was found beneath a layer of volcanic ash from the Glacial Peak eruption dated about 6000 years ago. Selwyn Dewdney recorded over 100 pictographs and petroglyphs at Writing-On-Stone Provincial Park, on the Milk River.

The Cluny Earthlodge Village on the Blackfoot Reserve, 70 miles east of Calgary, was the Foundation's major project with field supervision by Harold A. Huscher. The site, at the edge of a cutbank near the Bow River, is composed of 11 depressions enclosed by a fortification ditch. The circular depressions (houses) are arranged around the periphery of the site with the ditch meandering around outside of them. The houses appear to be a part of the perimeter fortification in bastion style. Artifacts were abundant near the open center of the village. Affiliation with the earthlodge villages of the Upper Missouri River Valley is suggested.

Saskatchewan. The Saskatchewan Museum of Natural History had five parties in the field this summer under the general direction of Thomas F. Kehoe. The survey of the Squaw Rapids Reservoir area, a salvage project on the Saskatchewan River, was carried out in June by Kehoe and Gilbert Watson, a new member of the permanent staff of the Museum. H. Leslie Clendenen and Morgan Tamplin continued the survey through July and August. Sites located extend from early man localities to historic fur-trading posts. In the South Saskatchewan River Reservoir area a second salvage survey was made from June to August. This was a joint party of the National Museum of Canada and the Saskatchewan Museum represented by Zenon S. Pohoricky and John W. Bennett respectively. Sites in this area consist mainly of single component camps and of tipi rings.

Kehoe excavated for 12 weeks at the Gull Lake Bison Drive site, in southwestern Saskatchewan. This is a deeply stratified (18.9 feet) bison drive site in the uppermost layer of which a bison scapula pierced by a .32 caliber bullet was found. The upper three layers contained pottery of the Pisamiks tradition and lower levels appeared to be preceramic. There was a gradual change in projectile points from level to level. Skulls of *B. bison athebascae* (Woodland bison) were found 5 feet below the surface in the preceramic levels but appear to be later than had previously been thought for this area.

James A. Brown, stationed at La Rouge, recorded 11 new sites and tested two previously known sites in northern Saskatchewan. All are late prehistoric sites with ceramics of the Pisamiks tradition. He and Kehoe, on a canoe trip from Prince Albert to Cumberland House, recorded 11 historic fur trading posts, four prehistoric sites and an 18th century settlement. Robert W. Nero, Assistant Director of the Museum, on an ornithological field trip, located a site near Lake Athabaska that contained burins.

Montana. The Billings Archeological Society, recently formed, is publishing a newsletter, "Trowel and Screen." The editor is Mrs. Bobby Purcell, 32 Wyoming Avenue, Billings. The group has done some weekend work in systematically recording sites in that area and Stuart Conner has prepared a report of some very unusual pictographs from the Fish Creek site (24WL401). John Lumley and the Schwiddes began testing the Lumley Cave site and recorded materials in six stratigraphic levels.

North Dakota. From June 20 to August 26, W. Raymond Wood and a University of Oregon–State Historical Society of North Dakota–National Park Service field party excavated eight houses, 200 feet of palisade and cross-sectioned the fortification ditch at the Huff site (32MO11) some 18 miles below Bismarck. This is a fortified, bastioned, village site of long-rectangular houses. A new aerial photograph of the site shows the houses to be in irregular rows, rather than in regular streets as previously believed. Excavations were confined to a 100-foot strip along the Missouri River bluff edge that will be destroyed when the Corps of Engineers rip-rap the bank to preserve the site from wave erosion by waters of the Oahe Reservoir. Seven of the excavated houses were long-rectangular, but one was almost square in outline with the corners and walls tending to be somewhat rounded. It also had four center posts and closely spaced wall posts around all four sides. It is suggested that this house might represent a shift from long-rectangular to circular houses. Wood will continue work through the academic year at the University of Oregon on researches centered about the Huff site and its relation to earlier work done in the general area, under a National Science Foundation grant.

A Smithsonian Institution party directed by Robert W. Neuman worked from June 13 to September 1 on burial mound sites along the right bank of the Missouri River between Bismarck, North Dakota, and Mobridge, South Dakota, in the Oahe Reservoir area. The principal effort was at the Boundry Mound site (32SI1) on the state line. Three dome-shaped mounds, ranging from 3 to 5 feet high and 60 to 85 feet in diameter were excavated. Each contained a rectangular central burial pit covered with timbers and lined with matting. Around the timbers were bison remains (skulls, partial skeletons, and complete skeletons in articulation). The burial pits, 3 to 4.5 feet deep, contained from six to 14 secondary human burials, some coated with red pigment. Artifacts were generally associated with a single individual in each pit and included side-notched projectile points, triangular knives, bipointed drills, an obsidian end scraper, sandstone atlatl weights, a catlinite object, cigar shaped bone objects, tubular bone beads, bone awls, a bone pendant, a bear canine pendant, shell pendants, and worked mandibles of humans, dogs, and beaver.

At Site 32MO207, near the Huff site, one of three mounds was excavated but yielded only a single second-

ary human burial and no artifacts. At Site 32MO20, 6 miles north of the Huff site, one of eight mounds was excavated. It contained a rectangular, central, timber-covered burial pit with bison skulls, one secondary human burial, and no artifacts. At Site 39DW233 in Dewey County, South Dakota, one of two mounds was excavated and a single, primary, extended human burial was found on the mound floor. Artifacts were found on the rib cage of the skeleton and included seven dentalium shells, a tubular bead of bone, and an incised shell pendant in the shape of a thunderbird. No pottery was associated with any of these mounds.

South Dakota. Smithsonian Institution party Number 2, led by Warren W. Caldwell, worked on four sites from June 8 to August 11. Site 39LM222 in the Big Bend Reservoir area, on Medicine Creek, in Lyman County, was a large, diffuse village of La Roche complex. A small, circular house with closely spaced wall posts, four center posts, and a long entry passage lay just above an earlier structure of indeterminate pattern. A shallow ditch surrounding the deeper house suggests that the house itself may have formed a bastion or strong point in the fortification system. A third excavated house was a small, circular structure with widely spaced wall posts, four center posts, and long entrance. Pottery and other artifacts are homogeneous throughout the site demonstrating a single La Roche–Iona–Russel ware tradition in one occupation. Site 39LM224, nearby, is another La Roche village of diffuse pattern, but with only four houses apparent from the surface. One of these, a burned, circular house with widely spaced wall posts and long entry, was partially excavated.

On July 19, Caldwell moved to old Armstrong County (now a part of Dewey County) above the mouth of the Cheyenne River in the Oahe Reservoir area, and excavated one house in Site 39AR201, a large, compact village of 18 long-rectangular houses in rows but without apparent fortifications. This extremely long, narrow house, under 4.5 feet of overburden, had a low bench along the rear wall into which a shallow trench had been dug to receive the rear wall posts. Dentalium, native(?) copper, and abundant human bone scraps lay on the floor, as well as an ocher-covered human bundle burial associated with a bison skull. Pottery was consistently Thomas Riggs ware. Less than 500 yards downstream another large village, Site 39AR210, was tested and found to resemble 39AR201 in all respects except that it had a rectangular, bastioned fortification system. This site had been flooded by the Oahe Reservoir and re-exposed by a drop in water level. Recovery of archaeological feature details was consequently minimal but a good artifact sample was collected.

The third Smithsonian Institution party, directed by G. Hubert Smith investigated four historic sites from June 22 through August 19. The military post of Ft. Bennett (1870–91) in Stanley County, some 10 miles below the mouth of the Cheyenne River had been flooded by waters of the Oahe Reservoir and re-exposed making archaeological work impractical there. Record photographs were made and some historic specimens were collected but excavation proved useless. At the military post of Ft. Sully (1866–94), on the opposite side of the Missouri, in Sully County, excavations were rewarding and provided detailed outlines of some of the main structures. They also provided one of the largest known collections, obtained under controlled conditions, of military and civil objects of the period. Noteworthy is a large array of glassware, including "art glass," hundreds of bottles, medical department glassware, and household glass. Many of these are complete or little damaged and marked as to origin or purpose. Objects of earthenware in great quantity, Oriental porcelains, and numerous items of metal and leather were recovered. Strictly military objects are in the minority but unusual items of both military and civilian use will form a valuable comparative collection and future exhibit material. Even specimens of printers' type, used for printing official orders, were found.

Limited tests were made at Site 39ST202, believed to be the site of Ft. George, a trading post of the 1840's. Only the scantiest contemporary record of this post has been found, although it was visited by Audubon and is reputed to have been a major post of the fur trade. Tests located former log habitations and occupational debris of the period. The site is located in Stanley County, at the northeast corner of the Brule Indian Reservation in the Big Bend Reservoir area. This season's tests were preparatory to major excavation of the site in a future season.

Smith also did an emergency excavation of six human burials accidentally located by construction activities at the Big Bend damsite and reported by the Corps of Engineers. Interments were in wooden coffins and contained glass beads and other late objects, though no record of such graves has been found.

A University of Nebraska–National Park Service cooperative project, directed by Preston Holder, assisted by Dick Jensen and Ward Weakley, excavated at the Leavenworth site (39CO9), 7 miles north of Mobridge in Corson County, during June and July. The Leavenworth, or Lewis and Clark, consists of two villages located about 100 yards apart. It was visited by Lewis and Clark in 1804 and mentioned in the journals of several traders. The villages were visited by Ashley in 1823 with a loss of thirteen of Ashley's men in a battle with the Arikara. Later in the same year, Colonel Leavenworth destroyed the villages in retaliation but the following year the Arikara returned and reoccupied them, remaining there until the final abandonment in 1833.

Holder's party, primarily attempting to solve ethnological problems by archaeological methods, excavated four houses and tested portions of several midden areas. The houses were circular with four center posts around a central hearth, and varied from 40 to 60 feet in diameter. Entrances were found to only two houses, the others probably having been destroyed by later construction. Attempts to locate the fortification ditch and palisade in the lower village were unsuccessful. The artifact inventory was rewarding and included a cannon ball and large quantities of glass and metal objects along with the native artifacts.

Wesley R. Hurt, Jr., supervised a survey for the W. H. Over Museum of the State University of South Dakota, on the proposed Interstate Highway right-of-way in the Black Hills between Sturgis and Spearfish during the month of June. Assisting Hurt were William Buckles, Robert Gant, and Jose Wilson Rauth. Thirty campsites were recorded, many of which are of the Forager complex. Two weeks were spent excavating the Gant site, a hilltop area north of Sturgis. Stone-lined firepits were found here, associated with projectile points of McKean, Duncan, and Hanna types, as well as manos, metates, pulping planes, end scrapers, and ovoid scrapers, under some 3 feet of sterile overburden.

In July and August, Hurt excavated portions of the No Heart Creek site (39AR2) in old Armstrong County, some 3 miles downstream from Caldwell's excavations, as a W. H. Over Museum–National Park Service cooperative project. A long trench was excavated across part of the village, one complete house and parts of two others were cleared and a large area of the fortification system was uncovered. This was a small, compact village of circular houses in the La Roche tradition. The oval fortification system of ditch and palisade was unusual for a La Roche site in its complex of small bastions and entryways.

The above six parties (excluding the Highway Salvage work in the Black Hills) in the Dakotas this summer investigated 14 sites in the Oahe and Big Bend Reservoir areas as a part of the Inter-Agency Archeological Salvage Program. Construction schedules are rapidly closing in on the salvage program. Oahe will be flooded by 1963 and Big Bend will be flooded in 1964. In Oahe, 91 of the 398 sites have been investigated. In Big Bend, 47 of the 171 sites have been investigated. Obviously, a great deal remains to be done wtih little time remaining in which to do it.

Nebraska. The Nebraska State Historical Society had two parties in the field during June, July, and August, under the general direction of Marvin F. Kivett. Work was continued at the site of Ft. Atkinson (1820–27), on the Missouri River in Washington County, as a cooperative project with the National Park Service to carry on research begun here in 1956. John Garrett, the immediate supervisor, excavated in buildings outside the fortified area, including the blacksmith shop, dugout storehouses, and the armorer's shop. In the fortified section, the east entrance and the southwest line of barracks forming the wall were tested. Ft. Atkinson, located on the site of Lewis and Clark's Council Bluffs, was established to protect the fur trade and was the first U.S. military post west of the Missouri River. It is now threatened by urban expansion of the city of Omaha.

The second project, supervised by Roger T. Grange, Jr., was a cooperative project with the Nebraska Game and Parks Commission for the study of Ft. Kearney State Park, on the Platte River near Kearney, Nebraska. Grange, assisted by Wendell Frantz tested a blacksmith shop area, a rectangular fortification section erected in 1864, and several storehouses and dwellings. The immediate objective was to locate and identify ground features and exhibit specimens, and to provide locations for future administration buildings.

Earlier in the year, Kivett made a survey of the Red Willow Reservoir area in Frontier County, southwestern Nebraska, locating several Upper Republican villages that will need to be excavated before flooding in 1961. He also carried out limited surveys in highway right-of-ways.

Kansas. Roscoe Wilmeth continued the survey, begun in the fall of 1959, of the John Redmond Reservoir area in east-central Kansas, for the Kansas State Historical Society in cooperation with the National Park Service. Thirty sites were located, a majority of which relate to the Central Plains phase and contain Pomona ware pottery. Two Plains Woodland sites and several nonceramic campsites were also recorded.

Thomas A. Witty excavated four sites and tested several others in the Wilson Reservoir area on the Saline River in Russel and Lincoln counties, central Kansas, another Kansas State Historical Society–National Park Service cooperative effort. At Site 14LM301 a house floor and associated outside pits were excavated. At Site 14-LN302, a small rock shelter with cultural material to a depth of 4 feet was recorded. Site 14RU302 was a stratified, two-level campsite buried under 3 feet of silt. Site 14RU303 was a shallow area of small pits and scattered postmolds on a terrace overlooking the Saline valley. All four sites relate to the Central Plains phase on the basis of initial appraisal of the pottery. Several new pictograph sites were also recorded in this immediate area.

On July 1, a new position of State Archeologist was established at the Society with full time duties in archaeological research. Wilmeth, formerly Assistant Museum Director, held the position until August 25, when he resigned to continue graduate work at the University of Michigan. Witty, who served as Assistant Museum Director, during the summer, became State Archeologist on August 25. The Memorial Building housing the Society is being remodeled to allow expanded museum space and office, laboratory, and storage space for the archaeological program.

Texas. The Texas Archeological Salvage Project of the University of Texas, directed by Edward B. Jelks, completed excavations begun in 1959 at the Kyle Rockshelter (41HI1) in the Whitney Reservoir on the Brazos River. The deep, stratified deposits of Central Texas aspect material contained Austin focus remains in the lower levels and Toyah focus remains in the upper levels. The latter were dry and produced coiled basketry, cordage, and wooden artifacts, the first such specimens found associated with the Toyah focus.

The Project also spent two weeks in August and September continuing the work begun in September, 1959, at the Oblate Rockshelter (41CM1) in the Canyon Reservoir on the Guadalupe River with Curtis D. Tunnell in charge. Pedernales, Bulverde, and other barbed points appeared in the lower levels with later levels producing Ensor, Frio, and Uvalde types of dart points. Austin and Toyah focus materials were found in a thin top level

above the Archaic. This stratigraphy of types has been substantiated at the Schneider site, a burned rock midden near Georgetown being excavated on week ends by the Travis County Archeological Society. Further correlation of this sequence is seen at the Crumley site (41-TV86), a burned rock midden in Travis County, excavated by Thomas Kelly of San Antonio. Here an early horizon contains shouldered, unbarbed points, such as Nolan and Travis types, and a later horizon contains barbed dart points such as Pedernales and Bulverde types. The latter correlates with the early Archaic levels at the Oblate Rockshelter.

A chronological ordering of certain Archaic, Edwards Plateau aspect projectile point types is beginning to emerge. Unbarbed dart point types with rectangular stems mark the early Archaic. These are replaced in the middle Archaic by barbed dart points with rectangular stems and the late Archaic is characterized by side-notched, expanding stem dart points.

The Pat Parker site (41TV88), in Travis County, was partially excavated on week ends in July and August, by University of Texas students, directed by Kenneth H. Honea. This Austin Focus cemetery and occupation area provided a series of human skeletal remains that are being studied by Thomas W. McKern, at the University. Honea, recently from Austria, became an assistant archaeologist on the staff of the Salvage Project at the University in June. Dee Ann Suhm, recently from the Glen Canyon Project at the University of Utah, became Curator of Anthropology at the Texas Memorial Museum on July 1.

MEXICO. J. F. Epstein made a survey of sites in northern Nuevo Leon and northeastern Coahuila as a joint project of the University of Texas, the Centro Investigaciones Sociales A. C., and the Institute of Latin American Studies. Along streams in this desert region, 70 sites of paleo-Indian, Archaic, and post-Archaic cultures were found. Plainview points were found in a site near Monterrey in apparent association with an impressive series of crude choppers, and similar choppers were found on other sites. Projectile points from Neuvo Leon sites relate to types common in southeastern Texas, while those from Coahuila sites resemble types of Trans-Pecos Texas. The Rio Grande apparently was not an effective culture barrier.

COLORADO. Joe Ben Wheat and a University of Colorado Museum party completed the excavation of the Olsen-Chubbuck site, a paleo-Indian bison kill near Cheyenne Wells, Colorado, between June 1 and August 20. This bone bed in an ancient arroyo contained the remains of a single kill of some 165 bison, tentatively identified as *B. occidentalis*. Some of the animals had been shot but many had been trampled to death attempting to cross the arroyo to escape. The presence of calves in the deposit indicates a late spring or early summer kill. Five projectile points, a large flake knife, and a slender, double-jointed bone implement were found this season, bringing the total inventory to 40 artifacts definitely associated with the kill and subsequent butchering, including 31 projectile points or fragments of Scottsbluff, Eden, Plainview, and intermediate types. A large body of data on butchering customs and techniques was also recorded.

Assembled by ROBERT L. STEPHENSON

SOUTHEAST

GEORGIA. The Macon Archeological Society completed the excavation of a large square ceremonial building at Brown's Mount, a Macon Plateau component near Ocmulgee National Monument. The structure is much like the Small-log Town-houses of the Norris Basin but has two tunnel-like entrances, east and south. It was covered with packed clay over cane matting. A. R. Kelly's previous excavations at Brown's Mount had uncovered a circular earth lodge.

The salvage operations in the Walter F. George Reservoir continued throughout the spring and summer of 1960. Harold A. Huscher of the Smithsonian River Basin Program spent about six months in the basin preparing a preliminary archaeological appraisal. While there he tested Site 9 Qu–4 which showed Stalling's Island, Weeden Island, Mississippian, and historic Creek ceramics. Sites 9 Qu–39 and 9 Qu–40 proved to be natural mounds. He also tested two badly eroded mounds 9 Qu–1 and 9 Qu–5. Huscher also served as host for an informal meeting of those agencies excavating in the reservoir.

A. R. Kelly and the University of Georgia excavated at the Mandeville site under contract from the National Park Service. Most of the work was done in Mound A, where extensive Swift Creek remains were cleared. The conical mound was also sectioned with power machinery.

ALABAMA. David L. DeJarnette used students from the University of Alabama under a contract with the National Park Service to cut through the temple mound at 1 Br–15 and clear large areas at 1 Br–35. The latter site was felt to be the location of Tamaxle burials; some with trade goods were uncovered.

Florida State University operated a 1960 summer field school with the University of Alabama under the direction of Lewis H. Larson, Jr. The first excavations, at 1 Ru–101, substantiated the belief that the site is that of the Spanish Apalachicola Fort of 1689–91. Spanish olive jar and Majolica sherds were found as well as evidence of moat, wall, and interior buildings. At 1 Ru–18, believed to be the Apalachicola New Town, a very scanty historic occupation was encountered. Below this was an alluvial deposit containing nonceramic materials to a depth of 8 feet.

The Alabama Archeological Society now publishes a monthly newsletter, "Stones and Bones," and a quarterly journal. The Archeological Research Association of Alabama, Inc., has been chartered to finance excavations. Its first project was the preliminary excavation of a rock shelter in northern Alabama which contained pottery dating from fiber-tempered to Mississippian in the upper levels. The work was directed by DeJarnette and Steve B. Wimberly.

Kentucky. Douglas Schwartz, University of Kentucky, conducted a survey of Mammoth Cave National Park for the National Park Service involving both the cave and surface areas. He found the major occupation to be Early Woodland, associated with the gypsum mining operations. Traces of paleo-Indian, Archaic, and Mississippian occupations are also present. During the summer a University of Kentucky field party resumed excavation of a large Mississippian mound and village on the Cumberland River.

Tennessee. At the University of Tennessee, Michael D. Coe excavated four sites in the Barkley Reservoir. Two sites of the Late Tennessee Archaic were tested along with one Mississippian site and a site with both Woodland and Mississippian components. T. M. N. Lewis reports that a Mississippian salt pan sherd bears the imprint of a fabric very similar to Spanish lace. Coe, who has left Tennessee for Yale University, has been replaced by Charles H. McNutt.

Florida. Robert Steinbach of Florida State University excavated two Weeden Island Period burial mounds near Gainesville for the Florida State Museum. Four burials and a restorable vessel were recovered from the badly damaged mounds. The premound occupation contained fiber-tempered sherds. Steinbach also excavated, for Florida State University, in the Kelly (Chamblis) site near Destin, Florida. This is another Ft. Walton period burial area with numerous vessels accompanying burials. Looters had removed over 20 pots and two large clay, mushroom-shaped "ear pins." This same type has been found by Goggin in what appears to be a fortified cave and burial site near Marianna. Hale G. Smith and a party of students from Florida State University excavated an early 18th century building complex at St. Augustine for the St. Augustine Restoration Commission. The work is part of an historical, archaeological, geographic, and architectural program. Charles H. Fairbanks of Florida State University spent two months excavating and writing a report on the Ft. Walton Mound (OK–6). The work was financed by the City of Ft. Walton Beach which now owns the mound and plans to develop it as a city park. He found that the submound humus was apparently a pure Deptford village. The Ft. Walton burials in the top of the mound seem to be confined to the eastern half. All the burials were badly disturbed, but multiple extended burials were identified.

The Southeastern Archeological Conference met at Gainesville, Florida, on November 4 and 5 with John M. Goggin as Chairman. It was preceded by a conference on historic site archaeology arranged by Stanley South of Brunswick Town State Historic Site, North Carolina.

Mississippi. Paul Hahn of the Department of Sociology and Anthropology, University of Mississippi, has begun a state-wide site survey and welcomes any information on Mississippi sites.

West Virginia. The West Virginia Geological Survey with headquarters at Morgantown has added the position of State Archeologist. Edward J. McMichael has been appointed.

Assembled by Charles H. Fairbanks

CARIBBEAN

Venezuela. *Miranda.* The Instituto Venezolano de Investigaciones Cientificas (I.V.I.C.), located in Altos de Pipe, near Caracas, was established in 1958 as a center for research in the basic sciences. A department of anthropology, recently established in the Biological Section of the Institute and directed by J. M. Cruxent, is currently dealing with a number of the problems raised by recent discoveries of paleo-Indian materials in Venezuela. In these problems and in others, the department benefits from the multiple facilities available at I.V.I.C., such as phosphorous and fluorine analysis, and the fact that the Radiophysical Section is preparing to begin the first series of radiocarbon determinations made on the South American continent. I.V.I.C. also furthers the anthropological cause by training graduate students and by offering fellowships to Venezuelans for study in the United States.

Nueva Esparta. Excavation and restoration of the Spanish colonial town of Nueva Cadiz continue on the Island of Cubagua; a museum is being built to house and exhibit the cultural remains of the site which represent the beginnings of Venezuelan history. Cubagua also is serving as a field laboratory for anthropology students of the Universidad Central of Caracas.

Bolivar. In November, 1959, Cruxent, accompanied by Dr. and Mrs. Marcel Roche of I.V.I.C., made a surface collection of quartzite and obsidian flakes and implements of paleo-Indian type in a brief exploration of the rain forest of Altos de Hacha in the region of Canaima.

Andean States. From March to June of 1959, Berkely R. Lewis conducted an archaeological survey of western Venezuela under the joint sponsorship of the University of Pennsylvania and the Museo de Ciencias Naturales of Caracas, with the aim of clarifying and enlarging knowledge of Venezuela's Andean regions. The principal sites of the fifty he visited, and in some cases excavated, are: Quibor, Guadalupe, Tocuyo, Arenales, and Camay in the state of Lara; Sabana de Monay (where he found a complete metate, a number of manos, and ceramic materials), Carache (where excavations revealed five distinct strata, extending some 7 m. beneath the present ground surface), Betijoque (where extensive ceramic materials were recovered that represent several new cultures, some of which are believed likely to tie village sites to the well-known figurines and other objects from mountain top caves in the region), La Ceiba, Valera, and Coloncito, in the State of Trujillo. Lewis also excavated a number of tomb burials (*mintoyes*) in the state of Mérida, and his survey included other sites in the states of Barinas and Táchira. The entire collection is at the University of Pennsylvania, together with 40 charcoal samples programmed for radiocarbon analysis at the Pennsylvania laboratory.

Falcón. Some eight years ago, a farmer found a mastodon tooth and several other Pleistocene faunal fragments exposed by erosion in a gully near his house in Muaco. He presented the finds to Rojas, Director of the Liceo Cecilio Acosta de Coro, who subsequently recovered a fairly large collection of paleontological material. This

collection was later studied by Royo Gómez of the Universidad Central of Caracas, who called the site to the attention of Cruxent. After several visits to the site, Cruxent decided to begin excavation in the hopes of finding human associations. The excavation, sponsored by the Museo de Ciencias Naturales, the Ministerio de Educación, the Universidad Central, and the Instituto Venezolano de Investigaciones Científicas — all of Caracas — began in 1959 and is still under way. To date, the excavations have yielded the following evidence in support of Pleistocene occupation of Venezuela: (1) a large number of bones of Pleistocene fauna, for example, *Glyptodon clavipes* (Owen), *Eremotherium rusconii* (Schaub), *Stegamastodon*, some of which bear marks of human industry, such as cutting and burning; (2) the association of typical lanceolate points and other lithic implements of the El Jobo complex with these bones; (3) a radiocarbon date of 16,375±400 B.P. determined from a sample of 5 kg. of bone material by H. N. Fisk of the Humble Oil and Refining Company Geological Research Center in Houston, Texas. As Cruxent points out, however, the site is in a disturbed state, and consequently the association of this date with the materials of El Jobo complex is not certain, nor for the same reason can the site be definitely identified as a kill site, although the burnt and cut condition of the bones make such an interpretation likely.

Cruxent has also begun excavating the coastal site of Iguanas, located to the east of Muaco. Pottery is found only at the surface of the deposit which is almost 20 feet thick, and the lowest levels of the site are apparently associated with a sea level lower than the present one.

Zulia. In a paper read before the 10th Annual Convention of the Asociación Venezolana para el Avance de la Ciencia held in Caracas March 20–26, 1960, Cruxent described and discussed the implications of a series of recent finds of lithic materials of paleo-Indian type from the region west of Lake Maracaibo. The discovery of these materials was made by one of Cruxent's students, Eddie Romero, during a visit to Manzanillo, a Guajiro Indian settlement just established on the outskirts of the city of Maracaibo. Since then, Cruxent, Romero, Erika Wagner, and others have located some 30 additional sites in the vicinity. All are either surface or shallow sites and are located at the base of a geologic formation known as El Milagro, which is believed to date from the Pleistocene. Thousands of specimens have been collected, but the total range of artifacts includes only large scrapers, choppers, flakes, hammerstones, and anvils. All of these implements have been formed only by percussion from a coarse textured mineralized wood. This technique of manufacture and the coarse nature of the raw material make all the artifacts singularly crude and primitive in appearance. This primitive appearance and the absence of projectile points suggest that the industry may be of great antiquity. The closest similarities are perhaps with some of the materials of El Jobo complex, but similar materials also are to be found in collections from the western United States and from Argentina. Unlike the Muaco site, no fossilized faunal materials have been found in association as yet, and the problem of dating the sites is currently being attacked by unraveling the nature of the association of the materials with the geologic formation of El Milagro.

In November, 1959, Patrick Gallagher completed five months investigation of the sequence of cultural development in the Maracaibo Basin. Almost all of this field work, which was supported by the Organization of American States and the Yale Department of Anthropology, was devoted to the excavation of La Pitía, a large, deep, stratified coastal shellmound located at the base of the Gunjira Peninsula. Standard excavation techniques were employed in screening some 200 tons of the several sand and shell strata of the mound; all of the cultural materials thus recovered are now being studied at Yale University. One result of this study to date is the tentative establishment of the following three major ceramic styles: (1) shallow, open bowls, sometimes boat-shaped, of a polished, thin black ware which is decorated with narrow incised lines. Figurines associated with this ware bear a red- and black-on-white design which consists of hatched lines projecting at right angles from a band; (2) ceramics of variable shape (including burial urns) decorated with curvilinear painted bands each made up of a series of thin lines flanked by two thick ones, which produce the negative impression of the background rather than the painted area being the design; and (3) simple rimmed vessels, sometimes surmounting an annular base, which is incised with broad, shallow, curvilinear lines, ending in dots. At times this incision is accompanied by applied strips which occasionally represent snakes, by applied punctated strips, and more rarely, by applied dots. Some of the traits of Style 1, the most recent style stratigraphically, and of Style 2, which underlies it, are shared with material from the Ranchería area of northern Colombia which forms Reichel-Dolmatoff's First Painted Horizon (*American Antiquity*, Vol. 19, No. 4). The stratum containing the characteristic sherds of Style 1 also contained manos and metates, as did the underlying stratum which yielded the diagnostic sherds of Style 2. Broad-line incised sherds, characteristic of Style 3 can be duplicated in the Venezuelan Tocuyano style whose type site, with a radiocarbon date of 2180± 300 B.P., is near the town of Quibor in the state of Lara (Cruxent and Rouse, *An Archeological Chronology of Venezuela*, 1958, pp. 152–5). The occurrence of this kind of incision is intriguing in the light of Willey's suggestion of the existence of a pre-agricultural, but ceramic, horizon extending south and east from Panama as the ancestral form of broad-line incision of northern Colombia and Venezuela and the West Indies (*American Antiquity*, Vol. 23, No. 4). In this regard, it may be significant that the broad-line incised sherds from La Pitía come from the lowest levels which lack the evidence for agriculture (manos and metates) found in association with Styles 1 and 2. Although La Pitía is primarily a habitation site, the excavations uncovered a restricted area where a succession of prehistoric occupants buried their dead. Examples of all classes of burials found in this area were exposed within a single 2 m.-square column.

Since some of these classes of burials were found undisturbed and directly superimposed over other classes, it has been possible to arrange all of them into a relative time sequence of three periods. Burials of the earliest and latest of these periods can be correlated on a number of grounds with the strata containing Styles 3 and 2 respectively. Since, as suggested above, these styles can be cross-dated with both Colombian and Venezuelan materials whose ages are known, it should be possible to assign absolute dates to the burial periods as well. If so, one of the conclusions that follows is that urn burials exposed in the site are as old as some of the oldest pottery known for northern South America.

In March and April, 1960, Cruxent, Wagner, Romero, and Alberta Zucchi made several visits to a burial cave of the Guajira Peninsula, which is one of a number of such sites near Cojoro, a village in the Sierra de Cocina on the Colombian-Venezuelan border. Preparations were made for excavations to be conducted in the fall of 1960 by Romero, Zucchi, and other students of Cruxent, and surface collections were made of the materials found on the surface of the cave floor. These materials consisted of 55 large secondary burial urns, most of which were complete, capped with globular lids, and found to contain the red-painted bones of several individuals. Most of these burials appear to be recent; some of them can be attributed to the Guajiro Indians who today inhabit the Peninsula, and others are quite similar to those which have been described by Korn (Bennett, South American Area, *American Antiquity*, Vol. 1, No. 3) and previously thought to be limited in distribution to the east coast of the Peninsula. The materials are now in the anthropological laboratory of the Instituto Venezolano de Investigaciones Cientificas.

The West Indies. *Trinidad*. Elizabeth Wing, a graduate zoology student at the University of Florida, excavated in Indian middens on the island during the summer of 1959 in order to get animal bones for a study of the mammals of Trinidad.

Antigua. A group of Americans who winter on the island have been conducting excavations in a stratified site containing two ceramic levels at Mill Reef. At the invitation of Fred Olsen, a member of this group, Irving Rouse, visited the excavations briefly during January, 1959. He reports that at that time not enough work had yet been done at the site to characterize the pottery.

Barbados. Neville Connell, Director of the Barbados Museum and Historical Society, reports that last April ceramic, shell, and stone artifacts were exposed, as well as unassociated skeletal materials, during building excavations at Greenland in St. Andrews Parish. The ceramic material apparently represents several styles and includes slipped sherds with geometric painted designs, and legged bowls with indented rims. In a sequence recently formulated by Marshall McKusick (Distribution of Ceramic Styles in the Lesser Antilles, MS, doctoral dissertation, Yale University, 1960) for the neighboring island of St. Lucia, the slipped sherds belong to his earliest, Troumassée style, which has a radiocarbon date of A.D. 730± 110, and the legged bowls to his latest, Fannis style, which he tentatively identifies as Carib.

Haiti. During 1959 Paul Barker of Gorham State Teachers College (Maine) investigated 85 limestone caves in northern Haiti; few seem to have been occupied, but at least five contain burials. The Manigat cave site on Tortuga Island is unique in the kind and depth of fill (soft red breccia some 2 m. thick) and the number of burials (several hundred) it contains. Forty thousand bone specimens were found during brief excavation. A few of them were worked: beads cut from radii; drilled gouges carved from humeri to represent zemi; a frontal section drilled twice; and several drilled teeth. Other artifacts include seven shallow dishes unadorned except for crude applied handles, and alabaster, limestone, shell, and pearl beads. Food remains include 12 species of fish and mollusk and several of mammals and birds in addition to a dozen kinds of fruits, nuts, and seeds. Barker also excavated a village site on the mainland, recovering hundreds of thousands of shell, coral, and stone artifacts; the latter consisting of notched sinkers, balls, grinders, and celts, and adzes, some of which bear zemi designs in low relief. Pottery recovered is variable and occurs in equally prodigious quantities. The site is remarkable not merely because of the quantity of cultural materials it contains, but also because it yielded two specimens of pre-Columbian worked gold, the first reported for the area (See *Time* Magazine, October 10, 1960).

Puerto Rico. Ricardo Alegría, Executive Director of the Instituto Puertorriqueña, has prepared the following report on his organization's recent activities:

The Instituto de Cultura Puertorriqueña, an agency of the Commonwealth of Puerto Rico dedicated to study, preserve and promote all aspects of Puerto Rican culture, is also making research studies on the archaeology of the prehistoric period as well as the time of the Spanish conquest.

Projects have been approved to continue the restoration of ceremonial ball courts set up by the Taino Indians in Caguanas, Utuado. These courts will be totally excavated and rebuilt, in order to preserve them as a park. A small hall will be erected in the adjoining grounds to display the objects recovered during the process of the investigations. These ball courts are considered the most important archaeological site in the Antilles area.

In the field of colonial archaeology, work has been finished in the excavation and restoration of the historical site which comprised the first Spanish settlement in Puerto Rico: the city of Caparra which was established in 1508. In the course of the excavations, new pieces of metal and ceramics were discovered. The groundworks of the house built by Juan Ponce de León, father of Puerto Rican colonization and discoverer of Florida, have been carefully preserved and restored, and a small historic park has been established nearby. In the near future another exhibition hall will be erected at that site to keep all objects found during the investigations.

Excavation work has also been accomplished in the old "plaza de San José," located in the antique section of

San Juan City. The investigation has disclosed the history of this court and the changes to which it has been subject from the last half of the 16th century to the present. During the reconstruction process, some skeletons were uncovered, near the main entrance to the adjoining church. These burials date back to the 16th century.

Bahamas. An open refuse site on San Salvador Island, the first good one reported for the islands, has been located by Ruth G. Wolper, who plans to use the materials she is excavating as the core of a local museum that is to be established. The site is significant since it may have been occupied by the island's historic Indians, the first Columbus encountered in the New World.

The Virgin Islands. During April and the first week of May, 1960, Ripley P. Bullen of the Florida State Museum and Frederick W. Sleight of the Central Florida Museum directed a program of archaeological research on St. Thomas Island, under the joint sponsorship of their respective institutions and the William L. Bryant Foundation. They excavated the remnants of a shell midden at Krum Bay, where they found a nonceramic occupation, and initiated a test excavation of the Magens Bay site with the purpose of obtaining materials for ceramic analysis to clarify the nature of the pre-Columbian peopling of the island. The group also conducted a survey of St. John Island, under the direction of Sleight and the sponsorship of the United States National Park Service, in order to test the depth and scope of certain principal sites, particularly those in areas administered by the Park Service.

Assembled by PATRICK GALLAGHER

ANNOUNCEMENT OF THE ANNUAL MEETING

The 26th Annual Meeting of the Society for American Archaeology will be held in Columbus, Ohio, May 4, 5, 6, 1961. The Ohio Historical Society and the Ohio State University are the host institutions. The Deshler Hilton Hotel will serve as headquarters for the meeting. Formal sessions will be held in the Ohio State Museum and the Ohio Union.

The American Association of Physical Anthropologists, the American Ethnological Society, and the Central States Anthropological Society will also meet in Columbus at this time. Joint symposia on patterns of land utilization, cultural and biological continuities and evolution in Eskimos and Indians, and the prehistory of the Upper Great Lakes area are planned. There will also be a number of general sessions.

Douglas W. Schwartz is Chairman of the Program Committee, and Raymond S. Baby, Chairman of the Local Arrangements Committee. Titles and abstracts of papers should be sent before March 1, 1961, to Schwartz at the Museum of Anthropology, University of Kentucky, Lexington, Kentucky. Reservations for rooms must be made directly with hotels in Columbus.

The 27th Annual Meeting will be held at the University of Arizona, Tucson, Arizona, May 3, 4, 5, 1962; the 28th Annual Meeting, at the University of Colorado, Boulder, Colorado, May, 1963.

PUBLICATIONS OF THE SOCIETY FOR AMERICAN ARCHAEOLOGY

Send orders for all publications (except *Memoir* 14 and *Archives of Archaeology*) to Society for American Archaeology, 1530 P. Street, N.W., Washington 5, D.C. Remittance should accompany order. The publications of the Society are not available for exchange.

AMERICAN ANTIQUITY

A Quarterly Review of American Archaeology

Complete volumes still available are: Vols. 1, 2, $3.00 each; Vol. 10, $4.00; Vols. 14–17, 19, 20, $6.00 each. Volumes 3–6, 11, and 12 are completely out of print, and all other volumes are out of print in part. Single issues available are: Vols. 1, 2, Nos. 1–4, Vols. 7, 8, Nos. 3, 4, $1.00 each; Vol. 9, Nos. 3, 4, Vol. 10, Nos. 1–4, $1.25 each; Vols. 13, 18, 22, Nos. 2–4, Vols. 14–17, 19, 20, Nos. 1–4, Vol. 21, Nos. 1, 3, 4, $1.75 each; Vols. 23–25, Nos. 2–4, Vol. 26, Nos. 1, 2, $2.50 each.

MEMOIRS OF THE SOCIETY FOR AMERICAN ARCHAEOLOGY

Occasional publications of monograph length. *Memoirs* 2, 3, 9, 10, and 12 are out of print.

1. *Big Bead Mesa: An Archaeological Study of Navaho Acculturation, 1745–1812.* DOROTHY LOUISE KEUR. vi+90 pages, 4 plates, 5 figures. 1941. $1.00

4. *A Reappraisal of Peruvian Archaeology.* Assembled by WENDELL C. BENNETT. x+128 pages, 72 figures, 6 tables. 1948. $2.00

5. *The George C. Davis Site, Cherokee County, Texas.* H. PERRY NEWELL and ALEX D. KRIEGER. xvi+255 pages, 66 figures, 20 tables. 1949. $3.50.

6. *Archaeology of the Columbia-Frazer Region.* MARIAN W. SMITH. viii+46 pages, 4 figures, 3 tables. 1950. Bound and sold with No. 7, $2.50.

7. *Cattle Point: A Stratified Site in the Southern Northwest Coast Region.* ARDEN R. KING. xii+94 pages, 25 figures, 13 tables. 1950. Bound and sold with No. 6, $2.50.

8. *Radiocarbon Dating.* Assembled by FREDERICK JOHNSON. vi+65 pages, 2 figures, 2 tables. 1951. $1.50.

11. *Seminars in Archaeology: 1955.* Edited by ROBERT WAUCHOPE. x+160 pages, 6 figures, 5 tables. 1956. $2.00

13. *Paracas, Nazca, and Tiahuanacoid Cultural Relationships in South Coastal Peru.* WILLIAM DUNCAN STRONG. vi+48 pages, 18 figures, 4 tables. 1957. $1.00

14. *Danger Cave.* JESSE D. JENNINGS. xii+328 pages, 247 figures, 31 tables. 1957. Available only as *University of Utah Anthropological Papers*, No. 27, from University of Utah Press, Salt Lake City 12, Utah. $6.00.

15. *Modern Yucatecan Maya Pottery Making.* RAYMOND H. THOMPSON. x+157 pages, 48 figures. 1958. $2.50.

16. *The Belcher Mound: A Stratified Caddoan Site in Caddo Parish, Louisiana.* CLARENCE H. WEBB. xiv+212 pages, 142 figures, 4 tables. 1959. $3.00

17. *Prehistoric Agriculture at Point of Pines, Arizona.* RICHARD B. WOODBURY. xiv+48 pages, 16 figures, 4 tables. 1961. $1.50.

CUMULATIVE INDEX

A cumulative index of AMERICAN ANTIQUITY, Vols. 1–25, *Memoirs* 1–16, and the *Notebook* is in preparation.

ABSTRACTS OF NEW WORLD ARCHAEOLOGY

An annual volume of abstracts summarizing the literature of the preceding calendar year. The first volume, which covers the literature dated 1959, is in press.

ARCHIVES OF ARCHAEOLOGY

Occasional publication on Microcard of primary documentation of archaeological investigations and related materials pertaining to the New World. The series is published jointly by the Society for American Archaeology and the University of Wisconsin Press. See AMERICAN ANTIQUITY, Vol. 26, No. 2, p. 316 for a listing of the ten publications now available. Order from the University of Wisconsin Press, 430 Sterling Court, Madison 6, Wisconsin. Remittance should accompany order.

CONTENTS

The Archaic of the Lower Mississippi Valley ... William G. Haag 317
Stratigraphy and Seriation ... John Howland Rowe 324
Elaboration and Invention in Ceramic Traditions ... Robert L. Rands 331
Changing Patterns of Territorial Organization in the Central Highlands of Chiapas, Mexico ... Robert M. Adams 341
The Cogged Stones of Southern California ... Hal Eberhart 361
Earlier Structures within the Pyramid of the Sun at Teotihuacán ... René Millon and Bruce Drewitt 371
The Tipi Rings of the High Plains ... Carling Malouf 381
A Sequence of Figurines from West Mexico ... Gordon L. Grosscup 390
Clyde Kay Maben Kluckhohn — 1905–1960 ... 407

FACTS AND COMMENTS

Ultrasonic Cleaning of Artifacts: A Preliminary Consideration ... R. F. G. Spier 410
Fresh-Water Archaeology ... Donald P. Jewell 414
Quantitative Analysis of Shells from a Site in Goleta, California ... Roberta S. Greenwood 416
Some Ancient Sites in Greensberg and Ottawa Townships, Putnam County, Ohio ... Frederick Johnson and O. J. Neill 420
Cord Marking Versus Fabric Impressing of Woodland Pottery ... George I. Quimby 426
Fluted Points in Paris ... Philip E. L. Smith 428
The Use of the Term "Mixtec" in Mesoamerican Archaeology ... H. B. Nicholson 431
A Statistical Device for Comparing Trait Lists ... Y. T. Witherspoon 433

REVIEWS

Cruxent and Rouse: An Archeological Chronology of Venezuela ... Howard 437
de Laguna (editor): Selected Papers of the American Anthropologist, 1888–1920 ... Reed 439
Tax (editor): The Evolution of Man: Man, Culture, and Society ... Haag 439
Sahlins and Service (editors): Evolution and Culture ... Willey 441
Dole and Carniero (editors): Essays in the Science of Culture in Honor of Leslie A. White ... Rouse 443
Marriott: The First Comers, Indians of America's Dawn ... Rachlin 444
Clark: The Prehistory of Southern Africa ... Washburn and McCown 445
Gebhard: Prehistoric Paintings of the Diablo Region of Western Texas ... Cain 445
Martin and Rinaldo: Excavations in the Upper Little Colorado Drainage, Eastern Arizona ... Sayles 446
Adams: Ninety Years of Glen Canyon Archaeology, 1869–1959 ... Lister 446
Vivian: The Hubbard Site and Other Tri-wall Structures in New Mexico and Colorado ... Smith 447
Irwin and Irwin: Excavations in the LoDaisKa Site in the Denver, Colorado, Area ... Wendorf 448
Aschmann: The Central Desert of Baja California: Demography and Ecology ... Drake 449
Harrington: The Ozark Bluff Dwellers ... Chapman 449
Robbins: Wapanucket #6, an Archaic Village in Middleboro, Massachusetts ... Kinsey III 450
Wolf: Sons of the Shaking Earth ... Ekholm 450
Bierhenke and others (editors): Amerikanistische Miszellen ... de Borhegyi 451
Zevallos Menéndez and Holm: Excavaciones Arqueológicas en San Pablo ... Lathrap 452
Palmatary: The Archaeology of the Lower Tapajós Valley, Brazil ... Easby 452

Notes and News ... 454
Announcement of the 26th Annual Meeting ... 467
Sale of Publications ... 468

AMERICAN ANTIQUITY IS INDEXED IN THE INTERNATIONAL INDEX

UNIVERSITY OF UTAH PRESS, SALT LAKE CITY, UTAH